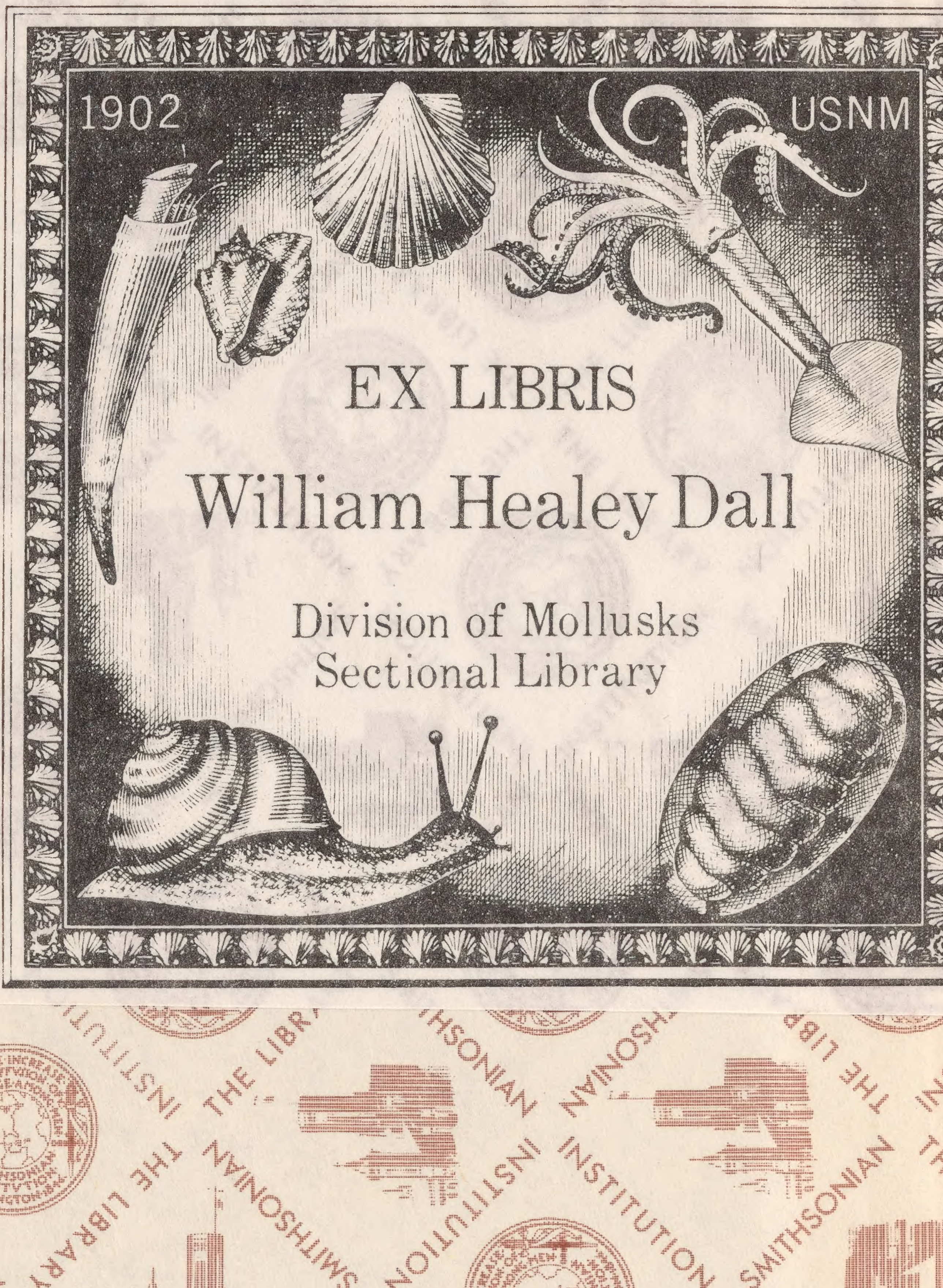

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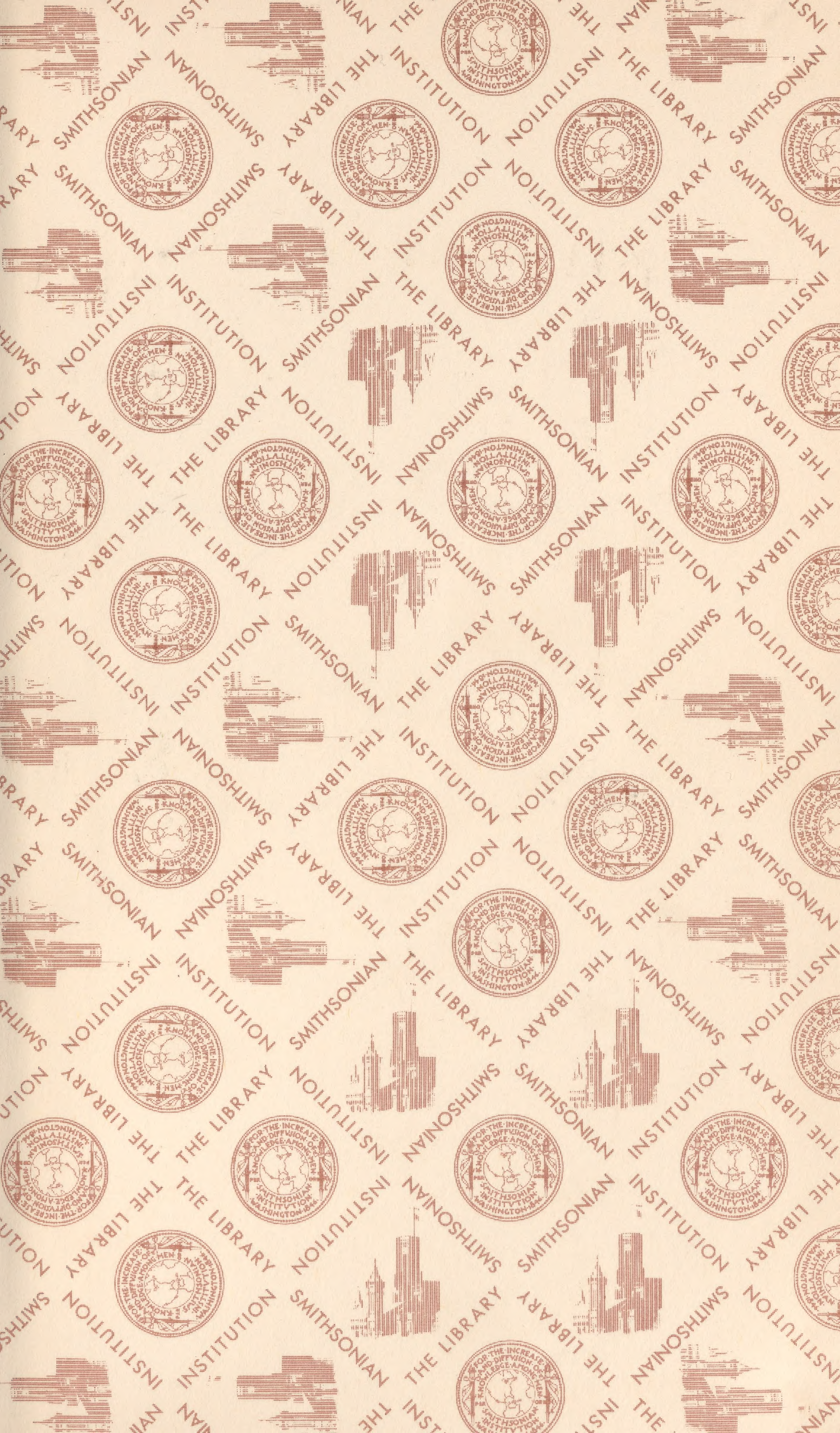
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PLATES

Plate.		*Facing page.*
1	*Astraea heliotropium* (Martyn)	12
2	J. R. le B. Tomlin	29
3	Malayan *Cypraea*	90
4	*Corilla lesleyae* Barnacle	96
5	*Pila africana koleensis* Venmans	140
6	*Synapterpes promoussonius propinquus* Crowley .	144
7	*Plekocheilus* (*Eurytus*) *taquinensis* (Pfeiffer) .	234
8	*Placostylus fibratus* (Martyn) and subspecies *kumacensis* Pain	276
9	*Gyrina gigantea* (Lamarck)	351
10	Hugh Watson	407
11	H. H. Bloomer	448

QL
401
Q15
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NEW NAMES PROPOSED IN VOLUME 24.

	page
Pomacea cumingi urabaensis Pain, 1956	75
Corilla lesleyae Barnacle, 1956	95
Pila africana koleensis Venmans, 1956	141
Synapterpes (*Promoussonius*) *propinquus* Crowley, 1956	144
Hygromia cinctella var. *translucida* Biggs, 1957	177
Megalomphalus mosselensis Barnard, 1957	180
Siphonaria asghar Biggs, 1958	249
Placostylus (*Placostylus*) *fibratus kumacensis* Pain, 1958	276
Jaminia (*Euchondrus*) *continens parthica* Forcart, 1959	316
Jaminia (*Euchondrus*) *continens carmanica* Forcart, 1959	316
Eremina desertorum var. *dancei* Biggs, 1959	332
Cancellaria euthymei Barnard, 1960	438
Admete decapensis Barnard, 1960	439
Nux Barnard, 1960	439
Nux alabaster Barnard, 1960	440
Thalassocyon Barnard, 1960	440
Thalassocyon bonus Barnard, 1960	440

oll.

VOL. 24] 20 DECEMBER 1954 [No. 1

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CONTENTS.

PAGE
A Fauna with *Helicella striata* (Müller) in the Cray Valley, Kent—A. G. DAVIS 1
Captain Cook's Imperial Sun Trochus—G. L. WILKINS . 7
Helix pomatia L. with abnormal genital ducts—H. E. QUICK . 12
The Mollusca of Patrick's Wood, Bromborough, Cheshire—N. F. MCMILLAN 13
The possible dispersal of *Pisidium* by Corixidae—C. H. FERNANDO 17
Helicella elegans (Gmelin) at Walmer, Kent—A. G. DAVIS . 19
A sinistral *Pupilla muscorum* (L.)—A. G. DAVIS 19
New locality for *Hygromia limbata* (Draparnaud)—L. W. STRATTON 20
A further note on *Agriolimax caruanae* Pollonera—J. F. HAYWARD 21
Arion ater (L.) and *Arianta arbustorum* (L.) feeding on carrion—G. W. PITCHFORD 22
Eggs of *Theba pisana* (Müller)—G. W. PITCHFORD . . . 22
The shell collections of E. R. Sykes—W. J. REES . . . 23
Blackbird feeding on *Arion subfuscus*—G. W. PITCHFORD . 24
A note on the numbers of Snails—N. F. MCMILLAN . . 24
Review: Mozley, *Introduction to Molluscan Ecology*—H. E. QUICK 25
Field Meetings 25
Proceedings: 24 April, 15 May, 16 October, 1954 . . 27
PLATE 1

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A FAUNA WITH *HELICELLA STRIATA* (MÜLLER) IN THE CRAY VALLEY, KENT.

By A. G. DAVIS, F.G.S.

(*Presidential Address delivered at the Annual Meeting, 20 February* 1954.)

IN the latter part of 1953, road widening operations by the Kent County Council revealed interesting deposits belonging to the Cray-Darent drainage, at Pratt's Bottom in the Cray valley, yielding a terrestrial molluscan fauna associated with *Helicella striata* (Müller) and *H. geyeri* (Soós). Both these shells have been the subject of a recent paper by Sparks (1), based to a large degree upon Kentish specimens collected by A. S. Kennard and J. P. T. Burchell.

A long and intensive study of the Kentish deposits characterized in part by both these species has been made by Burchell (2, 3, 4 and 5) and his final results are about to be published. In the Kentish sequence there are seven loams, No. 1 being the lowest, while Loam Nos. 4 and 5 are dated by the presence of Beaker pottery in situ between them [Burchell (3)].

Major Burchell has kindly examined the Pratt's Bottom faunal lists and concludes that the whole range of the deposits there conform with his loam No. 4 of the Greenhithe-Bean Valleys in Kent, and in age would be late Neolithic to Early Bronze.*

A perusal of the relevant literature shows that previous observers had detected nothing in the nature of a rich faunal assemblage in the Cray Valley. Sir Joseph Prestwich (7), in his classic on the Darent and Cray drainage, recorded the presence of *Pupilla muscorum* (L.) at Green Street Green, to the westward of Pratt's Bottom, while Kennard (MSS. collection at the British Museum (Natural History)) records *Succinea oblonga* Drap. from the same gathering. This association is absent in the section under notice and suggests an older deposit, and may belong to the Loessic beds post-dating the Main Coombe Rock [Burchell (6)]. Dewey (8) describes the deposits seen by him in the district, but in the absence of fossil records it is impossible to attempt comparison. King and Oakley (9) suggest that Burchell's calcareous loams with *H. striata* at Greenhithe belong to the Halling Stage (= Lower Flood Plain Stage and co-extensive with the buried channel of the Lower Thames). Sparks (1) concludes that *H. geyeri* did not survive the Pleistocene, while Burchell (*op. cit.*) maintains that both species persisted into early Holocene times.

---

* Since this address was written the writer has received much assistance from Major Burchell, who has personally guided him over and sampled all the seven loams at the type localities.

THE PRATT'S BOTTOM SECTION.

The excavations extend from the foot of Chelsfield Hill on the north side of the Sevenoaks Road to Stonehouse Lane, a distance of little over a quarter of a mile. The continuity of the section is broken near the centre by the lowering of the surface contour, and it becomes convenient to describe the deposits and their contents under two local place names. The western half is here called Chelsfield Hill and the eastern Stonehouse Lane, a name used by Prestwich and shown on the map. Chelsfield Hill shows melt water gravel at the base, overlaid by a yellowish marly loam, composed of a chalky sludge mixed with chalk pellets and occasional broken flint. Where fully developed it is 8 feet thick. Shells occur throughout, but are more numerous in its upper part and are recorded in the faunal list under *Bed a.*

Bed b succeeds and consists of from 4 to 8 feet of brownish marly loam, composed of similar materials to the bed below but containing more flints and humic material. The junction between the beds is uneven and in places *Bed a* is deeply furrowed and infilled with material from the bed above.

The Stonehouse Lane section shows at its western end about 4 feet of yellowish marly loam, *Bed c*, and towards the centre it is banked against a bluff of Coombe Rock, reappears on the other side of the bluff and dips below the surface.

Brown loams, *Bed d*, similar in composition to *Bed b* of Chelsfield Hill succeed and mask the top of the Coombe Rock. In the brown loams shells are more plentiful at the base, where in places there is a veritable layer of *Helix nemoralis* and *Pomatias elegans*.

NOTES ON THE FAUNA.

In all probability the fauna of *Bed a* is the equivalent in age and character of *Bed c* of Stonehouse Lane, and similarly *Bed b* is the same as *Bed d*, but the section is discontinuous and, until more records are available from these Kentish loams at type localities, the facts are presented as they were collected. Subsequent work will place this fauna into the general picture of the prehistory of this part of England. The record here presented is one showing that our snail population had re-habilitated itself after the close of the last glaciation, and in accepting the archaeological evidence available in the Greenhithe area an approximate date, 4000–3000 B.C., can be arrived at.

Bed a has a suite of 39 species, and the most characteristic species present suggest that the habitat was grassland with scrub. Woodland species are rare, so that only a thin belt of woodland was available. The presence of large examples of *Arianta arbustorum* requires a fair amount of dampness on an otherwise bleak, dry hillside. They no doubt found all their requirements for existence, as they do now on the face of the escarpment at Titsey, Surrey, by siting their colonies near the water table. The

FAUNAL LIST, PRATT'S BOTTOM, KENT.

	a	b	c	d
Pomatias elegans (Müller)	20	Ab	9	Ab
Acme fusca (Montagu)	3	92		47
Carychium tridentatum (Risso)	44	Ab	91	C
Cochlicopa lubrica (Müller)	33	70	35	45
,, *minima* (Siemaschko)		4		2
Columella edentula (Draparnaud)	2	2		1
Truncatellina cylindrica (Férussac)	2	9		45
Vertigo pusilla Müller	5	25		36
,, *pygmaea* (Draparnaud)	4	50	16	30
,, *alpestris* Alder	1	4		
Pupilla muscorum (Linné)	C	Ab	C	C
Lauria cylindracea (da Costa)		4		2
Abida secale (Draparnaud)	66	10	18	13
Acanthinula aculeata (Müller)	6	150	41	18
Vallonia costata (Müller)	C	C	20	C
,, *excentrica* Sterki	C	Ab	18	Ab
,, *pulchella* (Müller)	1	1		
Ena obscura (Müller)	1	7	4	6
Marpessa laminata (Montagu)	2	16	5	6
Clausilia bidentata Ström	2	40	10	32
,, *rolphii* Turton		10		2
Balea perversa (Linné)		1		
Cecilioides acicula (Müller)	53	C	13	C
Helicigona lapicida (Linné)	1	2		3
Arianta arbustorum (Linné)	15	6		5
Helix hortensis Müller	9	12	1	12
,, *nemoralis* Linné	48	C	50	C
Hygromia striolata (C. Peiffer)	18	77	1	58
,, *hispida* (Linné)	3	50	1	40
Helicella gigaxii (L. Peiffer)		22		2
,, *virgata* (da Costa)		2		6
,, *itala* (Linné)	70	C	2	20
,, *striata* (Müller)	2	1	1	2
,, *geyeri* (Soós)	6	1	1	6
Punctum pygmaeum (Draparnaud)	30	50	6	41
Discus rotundatus (Müller)	20	Ab	66	C
Arion sp.	28	C	37	C
Euconulus fulvus (Müller)	3	8		2
Vitrea crystallina (Müller)	10	96	20	30
Oxychilus cellarius (Müller)	18	23	21	30
Retinella radiatula (Alder)	4	2	1	
,, *pura* (Alder)	5	11	1	1
,, *nitidula* (Draparnaud)	6	9	2	10
Vitrina pellucida (Müller)	5	5		4
Limax spp.	6	12	5	8
Ova various spp.		20	6	4
Totals	39	46	30	42

a = Yellowish loam, Chelsfield Hill.
b = Brown stony loam, Chelsfield Hill.
c = Yellowish loam, Stonehouse Lane.
d = Brown stony loam, Stonehouse Lane.
C = Common = 100 to 200 examples.
Ab = Abundant = over 200.

nature of the deposit suggests very little humus with short turf, and the rarity of *Pomatias elegans*, compared with its abundance in the bed above, may mean that the chalk surface was bare and hard and unsuitable to its burrowing habits, but in this connection it is also likely that this species had hardly begun to establish itself in the area.

A common species is *Abida secale*, which at the present time is much reduced in numbers in the county, and has only a precarious hold in East Kent. *Acme fusca* is rare but becomes more plentiful in *Beds b* and *d*; it is rare living in the area, and formerly had a wider distribution and a greater abundance in this county and Essex.

Bed b has yielded 46 species; all the species of *Bed a* survive, but *Abida secale* has suffered a great diminution in numbers. The waning of this species had set in. There are some interesting newcomers, and some of the rare species of the lower bed became more numerous. Among them may be mentioned *Truncatellina cylindrica*, which if not extinct in Kent must be excessively rare. *Vertigo alpestris* is unrecorded from the county either living or fossil. Mr. M. Kerney and the writer have found a number of examples in the Holocene tufa at Wateringbury, Kent. In a living state in England it is confined to the northern counties.

Vertigo pusilla is another exceedingly rare shell in Kent; over 50 examples have been recovered from the brown loams. Among the newcomers are *Helicella gigaxii* and *H. virgata*, which are by no means common and are probably the leaders of invaders which have since colonized large tracts of our downlands. The fauna in constitution and numbers shows a considerable amelioration of climate compared with that of *Bed a*. There was a high humic content in the loam, so there was no doubt a good soil layer of which *Pomatias elegans* took full advantage. A sample of about 50 lbs. weight yielded over 300 shells of this species. The presence of seeds shows that there was sufficient cover and shelter so necessary for an abundant molluscan fauna. Woodland types have become more abundant and under the influence of a warmer period a snail paradise came into being.

Bed c with 30 species does not call for special comment.

Bed d with 42 species shows a close similarity to the fauna of *Bed b*, but it is important to note that six examples of *Helicella geyeri* were recovered from it. The extinction of this species in Britain took place about this time.

It is difficult to visualize the conditions which brought the sides of the hillside and all it supported to the level of the bottom of the valley and sealed it as a fossil deposit. That it happened there is no doubt, and that several such events took place in the valleys of Kent is all plain and visible to those who seek such signs. Southern England was for a long period under periglacial conditions, fluctuating between arctic and temperate conditions. Freezing of the soil and substrata decomposed the chalk, and at periods of melting a miry mass containing the remains of former life slid down to a lower level. The process of forming a new soil on the hillside began afresh and with it came the plants and animals, and so it went on in a cycle, the latest cycle being the present.

Soil and hill creep or wind erosion may or may not have contributed to the formation of these deposits, but while much has to be learned about these things, these deposits are quite common on the chalky tracts of Kent and further research will reveal them on the remainder of the chalk outcrop in England.

The hillsides above Pratt's Bottom at the present time do not present good conditions for snails, they have long been under cultivation and their lower levels are already being built upon. The snail population is now reduced to about 14 common hardy species, which are confined to the scanty and thin hedgerows which again are at present being destroyed. *Helix aspersa* is one of the commonest; it is a newcomer, for it finds no place in the fossil lists. *Hygromia striolata* is the most abundant species and has a greater claim to antiquity than the last, for it is a characteristic species in the loams.

ACKNOWLEDGMENTS.

The writer wishes to express his thanks to Mr. B. W. Sparks (University of Cambridge) for his specialist advice on the specimens of *Helicella* and *Vallonia* submitted to him for determination, and to Major J. P. T. Burchell for his advice on the age of the deposits and for his helpful discussions on Kentish deposits.

In particular I wish to acknowledge the invaluable assistance rendered by my brother, Mr. N. F. Davis, who shared with the writer the labours of excavating, collecting and transport of bulk samples from the site, and the preparation and sorting of samples in the laboratory.

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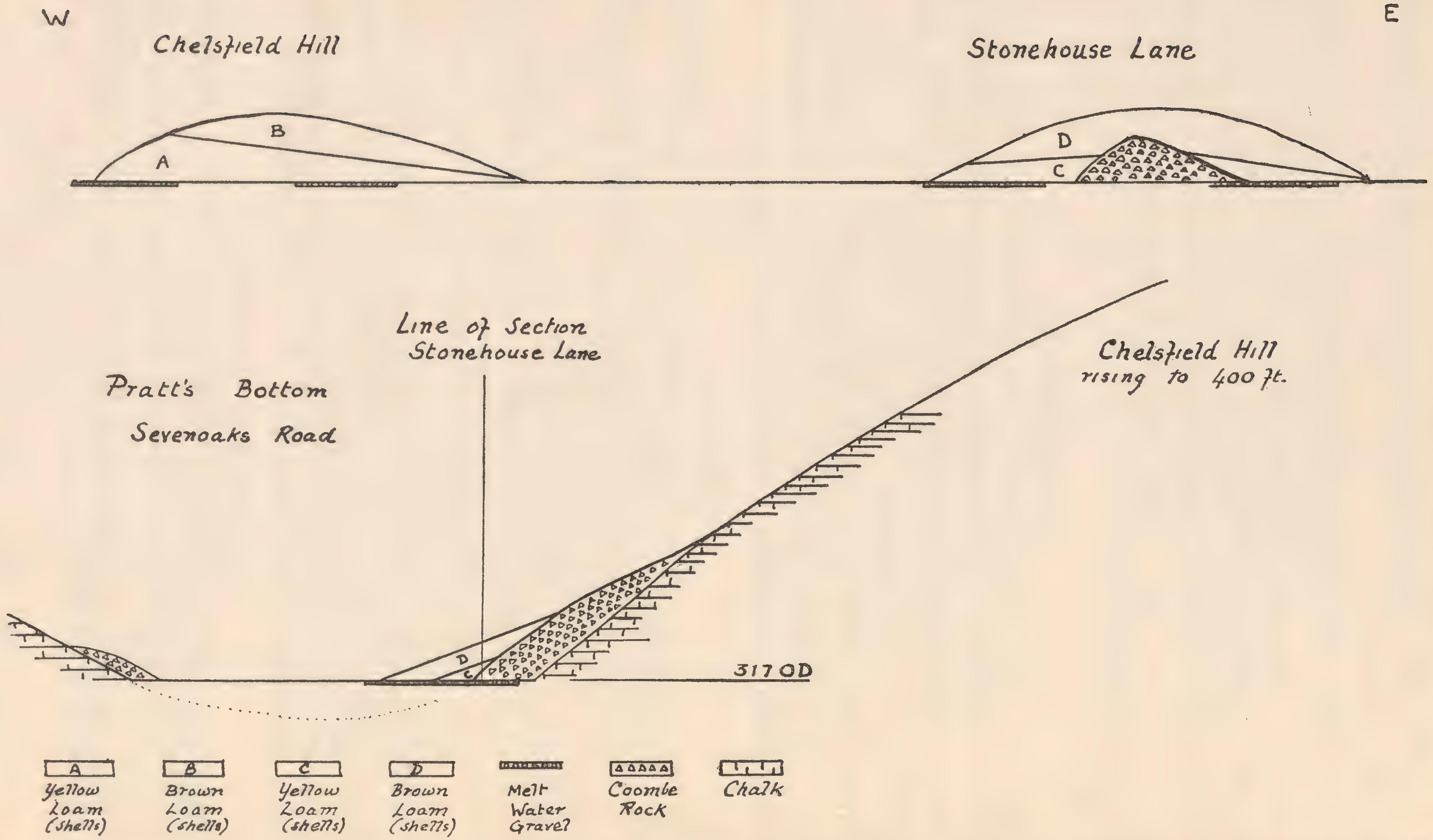
EXPLANATION OF TEXT-FIGURE.

Diagrammatic section of excavations in the Cray Valley between Chelsfield Hill and Stonehouse Lane, Pratt's Bottom, Kent, 1953–54.

Top: The Chelsfield Hill and Stonehouse Lane sections, showing the shelly loams A, B, C and D.

Bottom: Showing the relationship of the Stonehouse Lane section with the general features of the valley.


W
E
Chelsfield Hill
Stonehouse Lane
A
B
C
D
Line of Section
Stonehouse Lane
Pratt's Bottom
Sevenoaks Road
Chelsfield Hill
rising to 400 ft.
D
C
317 OD
A Yellow Loam (shells)
B Brown Loam (shells)
C Yellow Loam (shells)
D Brown Loam (shells)
Melt Water Gravel
Coombe Rock
Chalk

CAPTAIN COOK'S IMPERIAL SUN TROCHUS.

By Guy L. Wilkins.

[Plate 1.]

(*Read before the Society*, 19 *December* 1953.)

Among the plates devoted to conchology in the first volume of *The Naturalist's Repository* (1823), Edward Donovan included two finely coloured figures of a pale pink form of the New Zealand shell now known as *Astraea heliotropium* (Martyn), together with several pages of descriptive letterpress. Donovan was one of the most prolific writers on natural history in the early nineteenth century, and as the general style and phraseology of the text to plate XI of the *Repository* is so completely characteristic of the period, it may be of interest to quote his description in full. It reads as follows :—

CONCHOLOGY.

PLATE XI.

TROCHUS IMPERIALIS

var *a* Roseus

PINK, OR ROSEATE, IMPERIAL SUN TROCHUS.

Univalve.

GENERIC CHARACTER.

Shell spiral, more or less conic : aperture sub angular, or rounded, the upper side transverse and contracted : pillar placed obliquely.

SPECIFIC CHARACTER
AND
SYNONYMS

Shell conic, olive, covered with rows of arched violet scales : whorls inflated, with a spinous radiate margin : perforation funnel-shaped and white.

* Variety, pink or rose coloured.

TROCHUS IMPERIALIS : testa conica olivacea, squamis violaceis seriatis fornicatis tecta : anfractibus inflatis margine spinoso radiatis, umbilico infundibuliformi albo. *Gmel. Lin. Syst. Nat.* 3576.63.—var OLIVACEUS.

TROCHUS IMPERATOR *Chem.T.* 5.173.174.—var OLIVACEUS

a PINK SUN TROCHUS *Lev. Mus.*

" We cannot for a moment hesitate to believe that in announcing to our readers the introduction of the Pink, or Roseate Imperial Sun Trochus : the significant appellation under which the present rarity has been for many years distinguished, we shall awaken the attention of every Conchologist and amateur of the science. The shell so named, formerly constituted an object, no less conspicuous than beautiful, among the Conchological productions treasured together in the once celebrated Leverian Museum. And, as we possessed, through the immediate favour of the proprietor of the Museum, John Parkinson, Esq. an unreserved access to every article in the Museum, for the purpose of delineating the figures, or taking the descriptions of whatever we conceived worthy of such observation, it will be naturally imagined the Pink, or Roseate Imperial Sun Trochus, would be esteemed of too much importance to escape our very particular attention. The dispersion of that once celebrated Repository of Natural History has long since removed, and probably for ever, this exquisite rarity from the eye of public curiosity; nor indeed is its present destination correctly known; a circumstance, it is presumed, that cannot fail to enhance the value of a drawing, which we have every reason for believing to be the only memorial of this kind the pencil of the Arts have consecrated to the commemoration of the shell: the only figure, we are assured, the proprietor ever permitted to be taken from it. Having premised so far, it will not be deemed superfluous to add, that the outline of the specimen is precisely a fac-simile of the shell itself, having been traced round its contour while lying upon the paper, and being afterwards finished in colours upon the outlines so struck, with every attention an object so estimable was presumed to merit.

"The history of this curious variety of the Imperial Sun Trochus is altogether interesting, and deserves explicit mention; it is one among the number of those rare shells which were discovered by that distinguished navigator, Captain Cook, in his voyage round the world. It was fished up in the Straits that divide the Island of New Zealand, now distinguished after him, by the appellation of Cook's Straits. Upon the return of Captain Cook to England, he presented Sir Ashton Lever, among other articles of great curiosity, with this particular shell, the only one of its kind he had found. The Imperial Sun Trochus, of an olivaceous violet hue, the shell which constitutes the type of this species, though very scarce, occurred occasionally, but this Pink variety only in the solitary instance before adverted to: it was drawn up, adhering to the cable of the ship, from the depth, as it appeared, of sixty fathoms water.*

"In the general computation of the value of the various articles in the Museum of the late Sir Ashton Lever, submitted to government, previous to the grant of the Lottery which transferred the possession of that Museum from its original founder to the hands of Mr. Parkinson, this shell was estimated at the value of *one hundred guineas*: and as this value was arbitrary, that sum was considered as the worth of the shell while it remained in the Museum. At the final dissolution of this Museum, which took place in the months of May, June, and July of the year 1806, this shell, like the rest, was submitted to the chance of taste or caprice: it was sold on the last day of the sale, for the sum of twenty-three guineas, an amount considerably below its former valuation, but sufficient, nevertheless, to shew that its attractions were still great in the mind of the connoisseur.

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* This article is thus described in the last day's sale, lot 81. "An elegant and unique pink variety of the imperial sun, drawn up with the anchor of a ship, from the depth of sixty fathoms in Cook's Straits, New Zealand." Sold for £24 3s.

" The purchaser of this shell was at that time unknown, subsequently, however, the specimen appeared among the property sold at the residence of the Duke de Bourbon, immediately after the departure of that nobleman for France, in the beginning of the year 1815 (*In Orchard-street, Portman-square, Thursday, 13 April 1815. *Vide* lot 84.) Dr. Leach has since that time informed us that he had given instructions for the purchase of this shell for the British Museum : the shell does not, however, appear in that collection, and the lamented illness of our ingenious friend, is likely, for the present, to preclude all further inquiry respecting its final destination.

" It does not appear that this very curious variety of the Imperial Sun Trochus is known in any of the continental cabinets : the olivaceous kind, which as before observed, is to be regarded as the type of the species, though esteemed scarce, is to be found in every continental cabinet of importance. Indeed, the olive kind maintained a very high reputation and price for many years after the time of Captain Cook, who brought several of them to England ; from whence those continental cabinets were, in the first instances, supplied. Since that time the same seas have been attentively explored by Admiral Bligh, in the ships of his Majesty under his command ; and through his researches, this shell, which was once considered of such unusual rarity, has become rather more common. The Pink, or Roseate variety, the immediate object of our present illustration, has hitherto, however, escaped all research, and it still remains as it was esteemed originally, after a lapse of nearly fifty years, not merely scarce, but perfectly unique.

" An ingenious French writer of the present day, Denys de Montfort, in describing the olivaceous kind, the type, as before remarked, of the present species, has paid an appropriate tribute of applause to the memory of its original discoverers. ' It is,' says he, ' to the Voyages of the celebrated Captain Cook, and to the researches of the indefatigable Naturalists who accompanied him, that we owe the knowledge of this fine and magnificent shell.' ' This shell,' he adds, ' appears to be exposed to such a sworm of aggressors, that his Mollusca (or animal) must lead a life of activity and war : his shelly covering is ploughed, or furrowed, and pierced by a host of enemies, and he must necessarily employ almost the whole of life in repressing their attacks, and in constantly repairing the breaches and perforations they occasion, by the exudation of the nacrous molecules, or fluid, with which nature has furnished him, in order to preserve the inner coating of his shelly habitation entire.' Such is really the appearance of this shell in general ; we have seen it so completely despoiled of its exterior coating by these attacks, as to render it impossible to form any tolerable conception of the shell when perfect ; even an approach towards perfection in its outer coating is very rare. The most complete of its kind in the collection of the late Admiral Bligh, and probably selected as the best he ever met, was (more) perfect in this respect than might be expected.

By one of those rare chances which sometimes happen, the Roseate variety, which forms the subject of our present illustration, had entirely escaped every accident of nature, insomuch, that its figure may be regarded as that of a very perfect shell."

So wrote Donovan just over one hundred and thirty years ago, and it is now pleasant to record that in spite of his gloomy forebodings " this exquisite rarity ", the object of so many encomiums, is still in existence among the series of *Astraea* in the collections of the British Museum (Natural History), no doubt considerably faded through many years of exposure to the light in the old shell gallery, but still perfect. A manuscript label, written by Dr. Baird (Assistant in the Department of Zoology, 1841–1872) is attached to the specimen, and reads as follows : " Lot. 66. ' An unique variety of the Pink Imperial Sun-shell drawn up by the cable of the ' Discovery ' in Cook's Straits, New Zealand ; and purchased from the widow of Capt.ⁿ Cook by the late Ashton Lever '—Catalogue sold by Auction by Mr. Bullock, Egyptian Hall, Piccadilly 1819."

It will be seen that there are discrepancies between this label and the account given by Donovan quoted above, in which he alleged that the shell was given to Sir Ashton Lever by Cook himself, whereas the Baird label (apparently quoted from an earlier one) states that it was purchased from the captain's widow. Specimens of the normal or " olivaceous " *A. heliotropium* were brought back from all three of Cook's voyages, for Cook's Straits were visited each time, but if, according to the Baird label, this famous pink variety was taken by the *Discovery* it could not have been given to Lever by Cook himself, for the latter was killed by the natives of Hawaii before completion of the third voyage, in which the *Resolution* and *Discovery* took part. If the mention of the latter vessel on the Baird label is correct, then the shell must certainly have been purchased from Captain Cook's widow by Sir Ashton Lever, together with other personal curios handed to her by Lieutenants Gore or King, who brought the *Resolution* and *Discovery* back to England in October 1780.

Although the Baird label appears to be reliable there is, oddly enough, no mention of this particular specimen under lot 66 on any of the twenty-five days of the Bullock sale in 1819, nor indeed, in any other part of the catalogue. In his entry in the British Museum register on the fourth of June 1858, Dr. Baird included a copy of the label with the additional information that the shell was purchased from a Mr. Parkinson, but whether this was a descendant of John Parkinson, the former proprietor of the Leverian Museum is not known. The name may have been merely a coincidence, and it is obviously of little use speculating as to the probable wanderings of this shell between the Bourbon sale of 1815 and its reappearance in the British Museum register in 1858, but it is quite certain that it is the original of Donovan's plate first published in 1823.

Although Donovan believed his figure to be " the only memorial . . . consecrated to the commemoration of this shell " another drawing of it was apparently made before Parkinson's time, for in the sale catalogue of the Portland Museum the following item appears under lot 2656, sold on Monday 22 May, 1786 :—

> "*A remarkable high finished drawing by Peter Brown, of the Trochus* solaris L. *var. from New Zealand, in Sir Ashton Lever's Museum* . . ."

This drawing (purchased by George Humphrey, the shell and curio dealer, for the not inconsiderable sum of two pounds fifteen shillings), was probably commissioned by the Duchess of Portland soon after the arrival of the original in England, and even before it had been separated from the composite *Trochus solaris* of Linné by Martyn (1784) and Gmelin (1790).

Donovan's remarks regarding the general condition of the shells of *A. heliotropium* may be amplified by the result of a recent examination of thirty-three specimens, mainly from the British Museum collections. Of these, eight are entirely free from marine growths and of a pinkish shade; fourteen are free from growths and "olivaceous" in colour (a few attacked by boring organisms), and the remaining eleven are wholly encrusted and show no colour whatever. A close study of this fairly representative series also reveals the fact that juveniles are frequently of a deep pink, but that only a small proportion maintain this colour until maturity is reached, the larger proportion changing to the darker shade after completing the first two or three whorls. Heavy cleaning of mature pinkish examples produces a shade similar to the Cook shell, and it therefore appears that Donovan may have been carried away by his enthusiasm when describing his variety *roseus* as unique; moreover, had he examined the Museum collections when writing his description, he would have seen a small but perfect deep pink shell of *A. heliotropium* bequeathed to the British Museum with the Cracherode shells in 1799.

Most of these were sold to that eccentric but discriminating collector by George Humphrey, who received five guineas for this particular specimen, and eight guineas for a much larger but less decorative shell (vide Cracherode MSS. catalogue, Nos. 395, 396). Both of these examples of *A. heliotropium*, sold during the 1780's, must of course have been brought back from one of the Cook voyages, and are therefore contemporary with Donovan's figured specimen.

Suter (1913, p. 167) gives the following distribution of *Astraea heliotropium* in New Zealand and surrounding waters :—

"From the Bay of Islands to Stewart Island ; Cloudy Bay (Forster) ; Tasman Bay (Q & G) ; Auckland (Frauenfeld) ; Chatham Islands. From low-water mark to about 20 fathoms. Found also at Lord Howe Island. Brought to England by Captain Cook."

Powell (1946, pl. 13, f. 7) notes that it is a rare species, mostly from deep water. Fine specimens are still obtained by trawling from 50 fathoms in the Bay of Plenty (A. S. Voss, *in litt.*, 1950).

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EXPLANATION OF PLATE 1.

Fig. 1. Upper figure on plate XI of *The Naturalist's Repository*, Vol. 1, 1823.
Fig. 2. The specimen of *A. heliotropium* (Martyn) originally in the Leverian Museum and now in the British Museum (Natural History).

HELIX POMATIA L. WITH ABNORMAL GENITAL DUCTS.

By H. E. QUICK.

(*Read before the Society*, 16 *October* 1954.)

ON 14 July 1954 a specimen of *Helix pomatia* was received from Mr. A. E. Ellis, which was obtained from Mickleham, Surrey, and partly dissected by P. R. Salmon. Except that the lower end of the oviduct was divided, the specimen appeared to be intact. A little further dissection revealed a normal looking ovotestis with a few ova and spermatozoa in the follicles, and a normal hermaphrodite duct, with a well developed seminal vesicle overlapped by the lobes of a normal albumen gland. The prostate was normal in appearance, but ended without any trace of a vas deferens, and careful search under a binocular microscope yielded no trace of penis, flagellum, or retractor muscle. The oviduct was distended by undeveloped eggs of normal size, with granular calcareous shells coated with coagulated albumen, brownish in places. The spermatheca was normal, and also most of its duct with the usual short diverticulum, but the anterior end was free from the oviduct, closed and smoothly rounded, so it had not been divided in dissection as was at first thought possible. There was no trace of dart-sac or of mucous glands. The reproductive orifice appeared normal, but it is not possible to say exactly how the oviduct, vagina or atrium terminated.

Aphallicism occurs regularly in some small snails, e.g. some species of *Vertigo*, and is frequent in *Agriolimax laevis* (Müller), but in these cases the female ducts are normal. An occasional aphallic freak is seen in other snails, e.g. *Retinella nitidula* (Draparnaud).

It is not known whether the eggs in the present case were fertilized. If they were, spermatozoa from a partner must have ascended the oviduct directly, without being temporarily stored in the spermatheca, which is what normally occurs, or else the eggs must have been self-fertilized, but so far as is known self-fertilization has not been reported in *H. pomatia*.

SUMMARY.

A specimen of *Helix pomatia* is described in which the penis, vas deferens, dart-sac, and mucous glands are absent, and the spermatheca duct ends blindly.

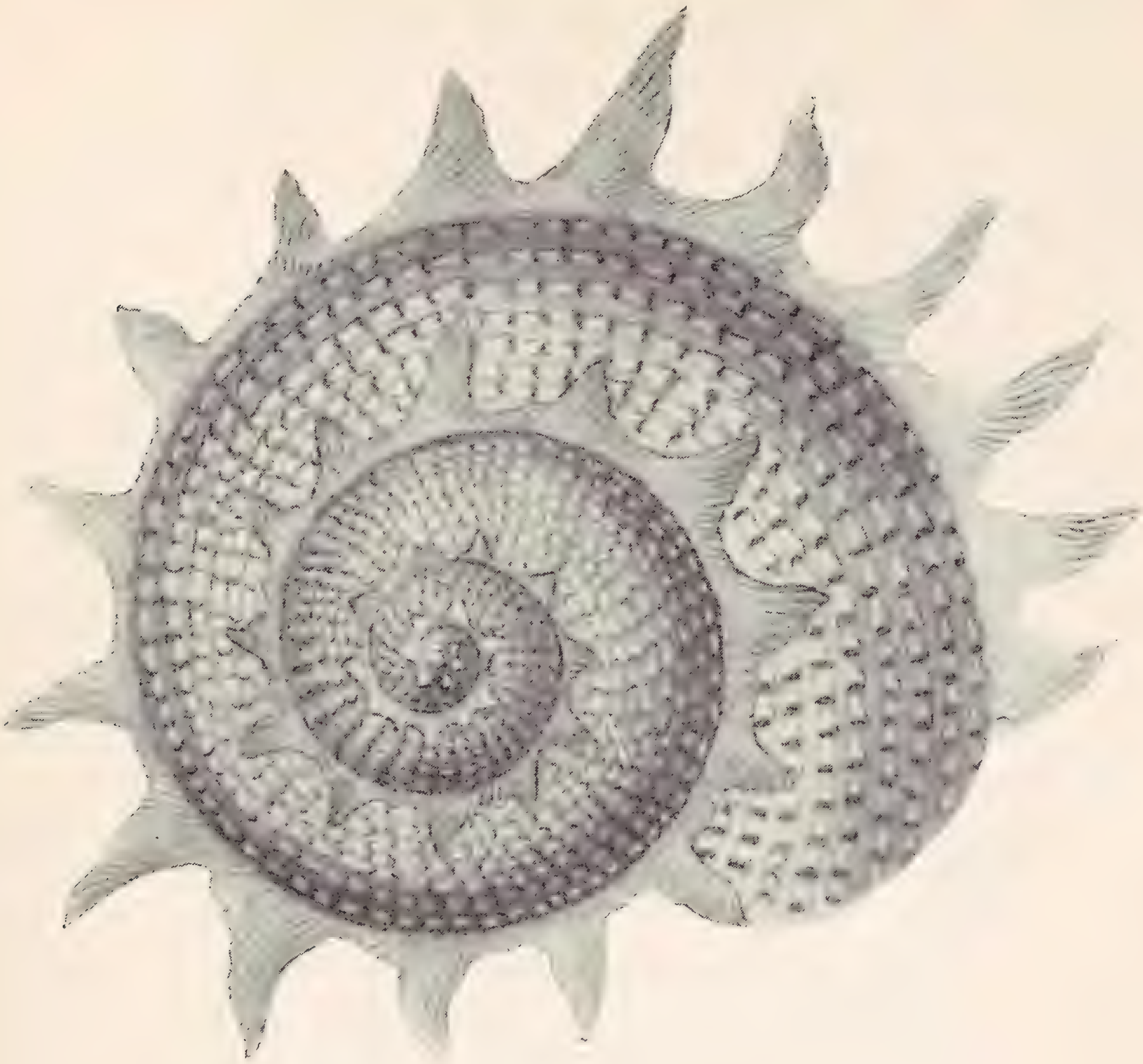

FIG. 1.

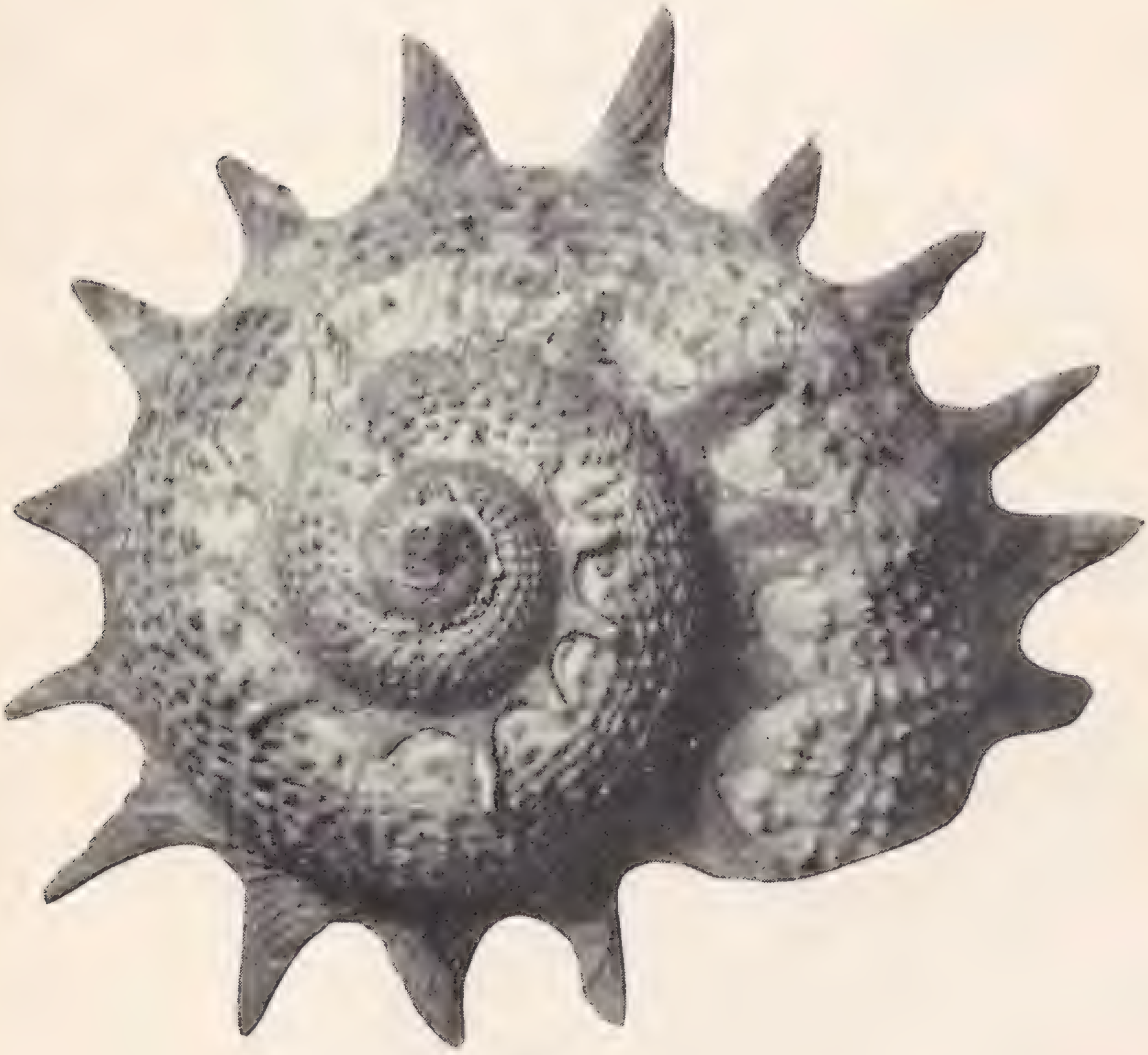

FIG. 2.

Astraea heliotropium (Martyn).

[*To face p.* 12.

THE MOLLUSCA OF PATRICK'S WOOD, BROMBOROUGH, CHESHIRE.

By Nora Fisher McMillan.

Cheshire is as a whole rather poor in land Mollusca, and the Wirral Peninsula is no exception. It is therefore pleasant to find that a small piece of native woodland known as Patrick's Wood has a molluscan fauna of about forty species, some of them distinctly uncommon.

Patrick's Wood is not marked as such on the 6-inch O.S. map Cheshire Sheet XXII, N.E., and appears to be a local name for the damp oakwood which clothes the steep right side of the Dibbinsdale valley, between the Birkenhead-Chester railway and the old Chester Road (now Spital Road, Bromborough). As the crow flies its greatest length is just over half a mile and its maximum breadth about 70 yards. The lower end of the strip of woodland, between Spital Road and the footpath leading to Spital railway station across the valley, is now a public park (Brotherton Park) and has been spoilt conchologically by path-making, Rhododendron-planting, etc. The next part, about 300 yards long, to which the name Patrick's Wood is now confined, lies between the footpath across the valley and the railway, the Dibbinsdale brook bounding its foot and gardens fringing the top. It has remained in private ownership and until recently has been but little interfered with. The Tithe Map (1840) marks it as " Dale Hill Rough ", extending then another third of a mile upstream as far as the bottom of the old Bromborough road called the Rake, and the lower end of what is now Patrick's Wood is marked Plantation on the same map. The line of demarcation between Dale Hill Rough and the Plantation is well marked even now, and the molluscan fauna of the latter is relatively very poor.

The geological formation is Bunter sandstone, overlaid with boulder clay, both almost non-calcareous, yet about halfway up the steep slope highly calcareous water oozes out in a number of places on the same level, and where it is most plentiful is the Petrifying Well, with the ruins of a small sandstone building round it. Hancox (1933) described the Well, and the molluscan fauna of the tufa deposited by it was listed later (McMillan 1947). A recent sample of the well water was kindly analysed by Mr. F. Burke and gave the following result : temporary hardness 22 parts calcium carbonate per 100,000, and the total hardness 30 parts.

The flora of Patrick's Wood consists mainly of oak (*Q. Robur*—dominant) and ash, with a shrub-layer of hazel, holly and hawthorn, together with some elder. The field-layer comprises abundant dog's mercury, wood anemone, wild hyacinth, etc. The wetter parts have thickets of guelder rose, with alder and willow, and in the more open areas are horsetail, *Iris*, meadowsweet, marsh marigold, etc. In the driest part (that closest to the railway line) are sycamores ; these were sown about 25–30 years ago by the then owner of the wood. Apart from these sycamores the flora of the wood is purely native.

The combination of native woodland and abundance of lime (there are numerous blocks of tufa) evidently affords a congenial habitat, as is shown by the list of Mollusca obtained. As regards previous records, a Liverpool merchant, James Wright Whitehead, has left us notes of his conchological discoveries in Patrick's Wood made in May–August 1856 (see Fisher and

Jackson 1936), and only one of these (*Balea perversa*) has not yet been refound. F. P. Marrat (1863) recorded *Vertigo antivertigo* and *V. substriata* from " Bromborough Wood ", possibly Patrick's Wood, but these two species have not been refound.

List of Species.

Acme fusca (Montagu). 2 shells, doubtfully recent, 1945 and 1947. Recorded by Whitehead, *fide* Cameron. Dr. Donald Cameron was a keen local naturalist, frequently mentioned in Byerley's *Fauna of Liverpool* (1856). His collection of shells was presented to Liverpool Museums in 1906.

Potamopyrgus jenkinsi (Smith). Frequent around the Petrifying Well and in other wet places. Smooth-shelled form only, although the keeled form has occurred in the stream bounding the foot of the wood.

Carychium minimum Müller (seg.). } A sample submitted to Mr. Watson gave 25 per cent *minimum* and 75 per cent *tridentatum*.
C. tridentatum (Risso).

Lymnaea truncatula (Müller). In trickle from Well and other wet places.

Succinea pfeifferi Rossmässler. In a wet unshaded spot, close to the stream; *det*. H. E. Quick.

Cochlicopa lubrica (Müller). Abundant. A white-shelled form (not albino, as the animal is coloured) also occurs occasionally.

Columella edentula (Drap.). Frequent in one very wet area, on *Iris*. Recorded by Whitehead.

Vertigo antivertigo (Drap.). } Both recorded by Marrat (1863) from " Bromborough Wood ".
V. substriata (Jeffreys).

Lauria cylindracea (da Costa). Sparingly distributed throughout.

L. anglica (Wood). Frequent in the wetter parts, sitting on very wet, but not rotten, fallen branches. A white-shelled form also occurs but the animal is coloured. Recorded by Whitehead and refound in 1942 by J. Armitage, who showed it to me. It has since been found frequently.

Acanthinula aculeata (Müller). 2 shells among dead leaves under a holly, 1947. Recorded by Whitehead.

Clausilia bidentata (Ström). Occasional, throughout. Recorded by Whitehead.

Balea perversa (L.). Recorded by Whitehead, but the most assiduous searches have not yet refound the species.

Arianta arbustorum (L.). Generally distributed throughout the Wood, but individuals apparently not abundant. It has colonized the foot of the adjoining railway embankment (railway opened 1840) towards Spital railway station, and also occurs sparingly in the woodland beyond the railway.

Helix nemoralis L. A dead but fairly fresh shell at the Petrifying Well, Oct. 1953. Although not yet found living in the Wood, two half-grown living examples were taken in the woodland just beyond the railway embankment, only a few yards outside the Wood, 1948.

H. hortensis Müller occurred in small numbers close by, again just outside the confines of the Wood, in 1947.

H. aspersa Müller. Occasional, near where garden rubbish is tipped. Lives in my garden at the top of the wood.

Hygromia hispida (L.). Thinly distributed throughout, but nowhere common.

Punctum pygmaeum (Drap.). One dead shell, 1947.

Discus rotundatus (Müller). Abundant throughout.

Arion intermedius Normand. 2 specimens. Oct. 1954.

Arion circumscriptus Johnston. Frequent.

A. hortensis Fér. Frequent, especially in the part adjoining gardens.

A. subfuscus (Drap.). One, Sept. 1951, det. H. E. Quick. It occurs elsewhere in Bromborough woodlands and is probably not uncommon.

A. ater (L.), *s.s.* Frequent. Several specimens, both black and brown examples, were submitted to Dr. Quick, and all proved to be *A. ater s.s.*, despite the variation in colouring.

Euconulus fulvus (Müller). Frequent.

Vitrea crystallina (Müller). Frequent.

Oxychilus cellarius (Müller). Generally distributed, but specimens usually not numerous. Recorded by Whitehead.

O. alliarius (Miller). Abundant. Recorded by Whitehead.

Retinella radiatula (Alder). Not common, several dead shells, one living specimen, June 1948.

R. pura (Alder). Fairly common.

R. nitidula (Drap.). Frequent. Recorded by Whitehead.

Zonitoides nitidus (Müller). With *Succinea pfeifferi*, very wet unshaded area.

Vitrina pellucida (Müller). Shells common. Alive, Nov. 1944.

Milax budapestensis (Hazay). The occurrence of this slug in such a " wild " habitat is of interest, as it usually prefers gardens. In Patrick's Wood it is found throughout, though not in large numbers. In neighbouring gardens it is, however, common.

Limax maximus L. Shells occur not uncommonly in various parts of the Wood, and in 1954 a colony of the slug was found in a thicket of guelder rose near the foot of the Wood.

Agriolimax reticulatus (Müller). Abundant. Dr. Quick kindly determined some specimens.

A. laevis (Müller). Not uncommon in the wetter parts.

Pisidium casertanum (Poli). } Living in the wettest places, *det.* A. W.
P. personatum Malm. } Stelfox.

Including Marrat's two *Vertigo* records, the above list totals 40 species. To show the abundance of snails a small bucket was half-filled with hepatics from the stones round the Well, and carefully searched. It yielded the following: *Lauria anglica*, 47 live specimens; *Oxychilus cellarius*, 40 alive, *Carychium* spp., 10 alive, *Discus rotundatus*, 4 alive, *Oxychilus alliarius*, 2 alive, *Cochlicopa lubrica*, 2 alive, *Agriolimax laevis*, 2, one shell each of *Vitrina pellucida*, *Retinella pura* and *Potamopyrgus jenkinsi*. This collection was made in January 1950, when many snails would not be very active, and it is evident that the snail population-figures for the Wood must be high.

A total of 40 species for any small area is a good list, but for Cheshire is remarkable. The well-worked Marple woods have yielded about 36 species (Oldham 1896; 1908), and Cotterill Clough (near Manchester), where conditions are similar to those in Patrick's Wood, has 20 species recorded from it, two of which, *Limax marginatus* Müller and *Hygromia subrufescens* (Miller), have not been found in Patrick's Wood, although conditions appear suitable for both.

It seems clear that the rich molluscan fauna of Patrick's Wood (as the locality is now understood) is due at least as much to the lime present in the form of calcareous tufa as to the shelter and moisture afforded. While not wishing to minimize the importance of shelter from desiccation as a factor of distribution, yet it is significant that in Brotherton Park (formerly the eastern end of Patrick's Wood) which contains no tufa and where the soil gave no fizzle when tested with hydrochloric acid, the molluscan fauna is very poor. Only the following have been found: *Succinea pfeifferi*, *Cochlicopa lubrica*, *Clausilia bidentata*, *Discus rotundatus*, *Arion circumscriptus*, *A. hortensis*, *A. ater*, *Oxychilus alliarius*, *Zonitoides nitidus*, *Agriolimax reticulatus*, *A. laevis*. Admittedly much of this part has been ruined conchologically, but there is still apparently suitable ground present.

Of the other uncommon (in Cheshire) species of Patrick's Wood none has been found outside the narrow confines of the Wood as now understood, which appears to represent a small last remnant of Cheshire's native woodland.

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My friend the late Harry Britten kindly gave me the Cotterill Clough data.

McClelland Index. A few copies of the *General Index*, edited by H. McClelland, are still available, and may be obtained from the Hon. Secretary, price £2. The *Index* includes all families, genera, species and varieties described and noted in the *Journal of Conchology* (vols. 1–16), the *Proceedings of the Malacological Society* (vols. 1–15), the *Conchologist* and the *Journal of Malacology*.

Correction. *J. Conchol.* **23,** p. 379, line 19: for "August and September" read "July and August".

THE POSSIBLE DISPERSAL OF *PISIDIUM* BY CORIXIDAE (HEMIPTERA).

By C. H. Fernando, B.Sc. (Ceylon), Hope Department of Entomology, Oxford University.

(*Read before the Society*, 24 *April* 1954.)

Bivalve Mollusca of the genus *Pisidium* are found commonly in isolated ponds. Boycott (1936) considers birds to be the chief animal agency in their dispersal, although he believes that aquatic insects may be effective over short distances. In a pond at Radley, Berkshire, six Corixidae were captured, four on 23 January and two on 7 March, 1954, each with a small bivalve attached to one leg. The bivalve was identified by Mr. A. E. Ellis as *Pisidium nitidum* Jenyns. About 30 more were seen but not captured. Some 50 Corixidae were taken from the same pond and kept in the laboratory in a square glass tank measuring 20 cms., with 10 cms. of water, containing about 50 *Pisidium nitidum* on a muddy bottom. In the course of a week 20 Corixidae acquired bivalves on their legs [*Corixa punctata* (Illig.), *Sigara distincta* (Fieb.), *S. striata* (L.), *S. fossarum* (Leach) and *S. lateralis* (Leach) (nomenclature of Macan (1939)]. 25 of the water bugs carried a single *Pisidium* and one carried two.

Corixidae in the pond concerned left it in numbers at the beginning of April (8th–11th). Specimens left behind were still carrying bivalves at the end of April.

Corixidae hold themselves to the bottom with the tarsal claws of the middle legs in the normal resting posture. When one of these claws is inserted between the two valves of a bivalve's shell, the valves close gripping the claw. It was noted that Corixidae carrying bivalves often lost them when taken with a water net. It is possible, however, to enclose such Corixidae within the net and take them directly out of the water with a pipette. The struggle of the Corixidae when the net is taken out of the water causes the tarsal claw supporting the mollusc to snap, as was shown by examination.

Kew (1893) records a number of instances of aquatic insects taken with bivalves attached to them. These are tabulated below. The number of instances is given in brackets.

	Insect.	*Bivalve.*
ODONATA.	(1) Dragonfly larva	*Sphaerium corneum* (L.)
HEMIPTERA.	(5) *Nepa* sp. undet.	(1) *Sphaerium corneum* (L.)
		(2) * *Pisidium fontinale* (Drap.)
	(2) *Notonecta* sp. undet.	(1) † *Pisidium etheredgei*
	(1) *Corixa* sp. undet.	(1) † *Pisidium etheredgei*
COLEOPTERA.	(8) ‡ *Dytiscus marginalis* (L.)	(5) *Sphaerium corneum* (L.)
		(1) * *Pisidium fontinale* (Drap.)
	(1) *Acilius* sp. undet.	* *Pisidium fontinale* (Drap.)

* *P. fontinale* is indeterminate ; probably *P. casertanum* (Poli) is intended.

† Reported from Sydney, Australia. I have not been able to trace the name of the author or present synonymy, if any.

‡ Two taken in flight.

He believed water insects to be of considerable importance in local distribution of small bivalves. Peacock (1917) found water beetles carrying *Pisidium*. Griffith (1945) records the frequent occurrence of small clams (bivalves) attached to the long abdominal fringes and legs of nymphs of Corixidae.

The Corixidae were 5–13 mm. long. The size given by Ellis (1940) for *Pisidium nitidum* is 4·5 × 3·2 × 2·5 mm.; the specimens on the Corixidae measured 3·0 × 2·5 × 1·5 mm. at the most and were young individuals. They varied in weight from 2 to 5 mgs., while *Corixa punctata* averaged 105 mgs., *Sigara striata* and *S. distincta* 20 mgs., *S. fossarum* 15 mgs. and *S. lateralis* 10 mgs.

Corixidae with attached bivalves swam about actively and continued to carry the bivalve for 2 to 3 days when placed in a separate vessel. Specimens placed on a dry sheet of paper and observed after 10, 15, 20 and 80 minutes, were found with the bivalve still attached.

Corixidae are often numerous in small ponds. A number of species have been shown to migrate in considerable numbers from one habitat to another. Among the species I have taken with bivalves, *Corixa punctata* and *Sigara lateralis* have high migration rates, while the rest also migrate [Hutchinson (1933), Macan (1938, 1939a), Macan and MacFadyen (1941), Brown (1951) and Popham (1952)]. Popham (1952) estimated that *Sigara striata* (L.), *S. germari* (Fieb.) and *S. nigrolineata* (Fieb.) could migrate about 6 to 8 miles on a windless day, and suggests that *Corixa punctata* has a greater range.

The only aquatic insect recorded in flight with a bivalve on it is *Dytiscus marginalis*. My observations show that at high temperatures in the laboratory Corixidae still carrying the bivalve can fly out of small containers. This indicates that the transference of small bivalves from one habitat to another by Corixidae is a possibility.

ACKNOWLEDGMENTS.

I wish to thank Professor G. C. Varley and Dr. B. M. Hobby for much helpful criticism and encouragement in writing this small paper.

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HELICELLA ELEGANS (GMELIN) AT WALMER, KENT.

By A. G. Davis, F.G.S.

For a long time it has been accepted that the Kentish colony of *Helicella elegans* near Dover had become extinct through industrial developments. In 1952 Mr. Michael Kerney discovered a thriving colony at the foot of Hawkhill Down, Walmer (*J. Conchol.* **23**, 341). On 30 August 1953 the writer, accompanied by Mr. T. Pain, paid a visit to the site, and *H. elegans* was soon found in large numbers in the short turf at the foot of the down only a few yards from the road (Liverpool Road). The colony reached only a few yards up the slope of the down, but extended laterally for some considerable distance, 100 yards or more, its limits being marked by wooded areas to the east and west. A small excavation for chalk makes a scar in the foot of the down, and snails were seen sitting on lumps of chalk. Its companions were *Helicella caperata* and *H. virgata*, both equally plentiful. Where tall or dense vegetation (e.g. Umbelliferae) was present, *H. elegans* was absent, such shelter being taken over by *Helix aspersa* and *H. nemoralis*. On the opposite side of Liverpool Road the springy turf was absent and likewise *H. elegans*. The Walmer site is seven miles in a direct line from Kearsney, the former locality for this snail. It would be interesting to find out whether there are any colonies in the intervening area. The Walmer site has much in common with that at Chaldon, Surrey (*J. Conchol.* **23**, 167), but is smaller, at a lower altitude, and less open and exposed.

A sinistral *Pupilla muscorum* (L.).—I can only find a single record of this monstrosity in Britain (*J. Conchol.* **13**, 25). It was exhibited by Mr. J. W. Baldwin at one of our meetings in 1909 and came from a shell pocket at Abersoch, North Wales. I can now add another record, this time from a hill or rain wash from a shallow road cutting in the main road leading into Weymouth, Dorset. In the sample I took there were 14 species, representing a fauna from grassland with scrub. *Hygromia hispida* was the most abundant species (29 examples). There were 8 examples of *Pupilla muscorum*, including the sinistral one. This specimen is less than half grown. There is nothing in the sample indicative of age and from what I could gather from a glance at the terrain this wash did not seem to be of any great age, but more likely to be post-Roman or later.

A. G. Davis.

NEW LOCALITY FOR *HYGROMIA LIMBATA* (DRAPARNAUD).

By L. W. Stratton.

In August 1954, *Hygromia limbata* (Draparnaud) was found at Kingskerswell, South Devon, between Newton Abbot and Torquay. This new locus is three miles in a direct line from Combe-in-Teignhead, where this species was first discovered in England by Kennard in 1917, and the same distance from Ellis' locality at Maidencombe.

The snail was first found fairly plentifully on banks covered with long grass, backed by poor and uneven hedges on the road running parallel to and immediately south of the railway and west of Kingskerswell church. Its commonest associate was *Hygromia striolata* (Pfeiffer), of which there were great numbers, and many of which were almost as conoid as *H. limbata*. *Helix hortensis* Müller was also common, and there were a few *Arianta arbustorum* (L.).

As at Maidencombe, the var. *serratina* Moq. was the most common, but the pale brown and white forms were also present. Full grown specimens with well-formed lips were in the minority ; young of all sizes were fairly common. The young of the white form presented a speckled appearance, due to the body pattern showing through the transparent shell. Huggins (1922) says, among other things, that it " does not appear particularly timid ", but at Kingskerswell it was most noticeable that *H. limbata* dropped off immediately the herbage was touched, whereas *H. striolata* remained quite firmly attached. On a wet evening, both species could be seen crawling on grass stems, and two or three of each on dead stems of Umbelliferae.

H. limbata was also found in small numbers in a lane parallel to and south of the previous locus. Here it was in grass, though one was seen on moss on the top of a five foot wall above the bank.

North of the railway line it was found among brambles and nettles growing against walls. Here again *H. striolata* was the commonest associate, though *H. limbata* was seen crawling on a wall with *Pyramidula rupestris* (Drap.) and *Lauria cylindracea* (da Costa).

At Combe-in-Teignhead the snail was still abundant. At one point it occurred in long grass, and the easiest way to find it was to lift up the grass where it drooped over the road. Snails could be picked up in dozens on the dead bents actually lying on the road.

It seems probable that *H. limbata* will be found to live in many situations in the area between the Teign Estuary and the Newton Abbot-Torquay road.

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A FURTHER NOTE ON *AGRIOLIMAX CARUANAE* POLLONERA.

By John F. Hayward, Ph.D., M.Sc., F.G.S.

The object of this note is to correct two errors in the previous paper (*J. Conchol.* **23**, 403–4) and to discuss one or two matters which have arisen since its publication. The corrections are :—

1. It is understood that the slug is named after Signor Caruana Gatto. The author accepted Pollonera's phrase "*Il Sig. Caruana trovò questa specie* . . ." without recognizing it as an abbreviation.

2. Pollonera stated that he had seen but one living specimen of the slug, a statement which was wrongly translated as "This author was not acquainted with the living animal". This is now corrected with thanks to those who have drawn attention to it.

The admittedly cumbersome phrase "*Agriolimax* cf. *caruanae* Pollonera *emend.* Quick" has caused some discussion among zoologists partly, it would appear, because in the Linnean Society *Synopsis* No. 8, p. 28, line 44, there is an unfortunate misprint, giving the name as *carunae* instead of *caruanae*. This misprint was not, however, in mind when the phrase was coined. It must be remembered that the paper was addressed primarily to palaeontologists who might possibly find shells of this kind in Pleistocene or Holocene deposits. Such shells, whose specific identification is undoubtedly tentative, cannot be referred to Pollonera's original description, for Pollonera neither described nor figured the shell. But Quick's emendation—the figuring of the shell—allows such identification to be hazarded. Thus the much misunderstood phrase, translated into English, means "This shell resembles the one figured by Quick in emendation of Pollonera's original description of *Agriolimax caruanae*". Consequently the author does not offer any withdrawal of this phrase, unwieldy though it may be.

Dr. Quick points out that the four shells which he presented to the author (plate 15, figs. 6–9) were not from fully grown individuals. The shell of *Agriolimax caruanae* can attain a length of 4·75 mm., and shells of this length would be even more like the fossil shells than those shown in figs. 6–9. Figures 1 and 2 are more doubtfully referred to this species. Dr. Quick also adds the following note :—

"It is true that Pollonera describes the keel as blackish, and in British adult *caruanae* it is the same colour as the rest of the back, but in very young individuals the general pigmentation begins at the tail and at the head, so that in them the tail is darker than the rest of the back. If this condition persists throughout growth in Malta, it would at most indicate a varietal or racial character. Pollonera also figures the spermatheca with a shorter duct and more globular sac than is found in British examples, but Pilsbry (1948, *Land Mollusca of North America* **2**, figs. 290–291) figures *Deroceras laeve* (= *Agriolimax laevis*) as varying in exactly the same way.

"Though attempts to obtain topotypes have been unsuccessful, it by no means follows that it has really died out in Malta, and the facts that it is found in 'wild' places in parts of Britain, and that Pilsbry (*op. cit.*

p. 560) reports that Mr. Glenn R. Webb dissected a slug with the same genitalia from Marseilles, suggest that *caruanae* has a wider distribution than was suspected, and it is not necessary to assume that it was imported by human agency from Britain to Malta or vice-versa. It may be pointed out that several slugs that are undoubtedly native are more abundant in gardens than in uncultivated places."

The writer wishes to thank Dr. Quick for his interesting observations.

It may be of interest to record that the author has now found an *Agriolimax* shell 4·5 mm. × 2·25 mm., with the characteristic concavity of the right margin, in the Holocene marsh clay of Nazeing, Essex. That the concavity was not merely a mutilation after the death of the slug is suggested by the growth lines on the dorsum of the shell, which indicate that the feature was present when the shell was no more than a millimetre in length. This constitutes a new record for the vice-county of Essex North.

***Arion ater* (L.) and *Arianta arbustorum* (L.) feeding on carrion.**—At Southwell, Notts, 30 May 1954, my daughter and I saw an *Arion ater* feeding on the right eye of a dead blackbird. I decided to watch what happened, by visiting the dead bird at hourly intervals. On the second visit I found the *Arion* had gone, and in its place was an adult *A. arbustorum* feeding on the bird's eye. On the next visit the *A. arbustorum* was still there, and a second one was crawling on the dead bird. I removed the snail, which was feeding on the bird's eye, to a distance of 18 inches; almost immediately it crawled back and went on feeding. The snail was again removed, with the same result. On the following morning the bird's right eye had completely gone. On 2 August 1954 I found an adult *A. arbustorum* feeding on a dead field mouse, which I watched for 20 minutes. It was feeding on the left side of the thorax, which was denuded of flesh, the ribs standing out gleaming white.

G. W. PITCHFORD.

Eggs of *Theba pisana* (Müller).—On returning home on 1 August 1954 from a collecting trip to Tenby, I placed a few specimens of *T. pisana* in a 2-lb. jam jar, in which had been placed a mixture of light soil and sand about one inch deep, and a few pieces of dead Umbellifer stems and leaves. One of the snails excavated a hole a little over half an inch in diameter at the side of the jar, and proceeded to lay eggs, which were white and about 1·5 mm. in diameter. I did not disturb the eggs to count them, but would say there were 40 to 50. I watched the eggs daily, and on 15 August they started to hatch, this being completed on the 16th. The young snails remained underground for 7 to 10 days. When they crawled out, the shells measured a little over 2 mm. in diameter. Though most have died, there are still a few alive at the time of writing (18 October). Taylor (*Monograph* **3**, 373) states that the eggs are usually about 60 in number, but said to be deposited at three different times, just beneath the surface of the ground, and hatch in about 20 days, bearing a shell nearly 2 mm. in diameter.

G. W. PITCHFORD.

THE SHELL COLLECTIONS OF E. R. SYKES.

By WILLIAM REES.

THE shell collections amassed by the late Ernest Ruthven Sykes of Littlemayne, near Dorchester, were donated to the British Museum (Natural History) a few weeks before his death. The shells are housed in four half-cabinets which are conservatively estimated to contain 76,000 shells, all named and localized and stored in round glass-topped boxes of the pill-box variety.

Sykes was a very active worker on Mollusca and published no fewer than 101 conchological papers, of which only five were in collaboration with others. An appreciation of Syke's contribution to our knowledge of the Mollusca and a list of his papers is to be published in the *Proceedings of the Malacological Society*, so full reference need not be made here.

Certain items were dispersed over a period of years, and are not represented in the collections now in the British Museum, but must be mentioned, so that future Curators of Mollusca may be spared fruitless search for specimens never received! Apart from a few type specimens, the collection of Clausiliidae was sold to an American museum between 1920 and 1930. The special collection of Dorset shells is in the Dorset Museum at Dorchester, but the fate of several series of Loricates has not been elucidated. In particular, it may be mentioned that the latter includes material reported on for Sir William Herdman. Over a period of years, too, the majority of the type specimens of the remaining collections were presented to the British Museum.

Apart from these gaps, the remaining collections are intact and contain the material on which his numerous papers were based.

Sykes devoted particular attention to the non-marine shells of the Indo-Malayan region and of the Indo-Pacific Islands, and the collection is particularly rich in land operculates. There is also a fine series representing his work on land Mollusca of Hawaii in *Fauna Hawaiiensis* (1900). He also reported (among others) on the land and freshwater shells of the Seychelles (1909).

The residual shells of the famous *Porcupine* Expedition 1869–1870, which had been sorted and preliminarily identified by J. T. Marshall, were purchased by Sykes who dealt with them in a series of five supplementary reports (1904–1925). This is a particularly valuable acquisition for the British Museum because much (but not all) of the Porcupine collection of Gwyn Jeffreys is now in the Smithsonian Institution, Washington. All the labels of the *Porcupine* shells are in the neat, legible hand of J. T. Marshall.

Some groups of other marine shells are also particularly well represented. Among these may be noted a series of Andaman shells, on which four papers were published in collaboration with J. C. Melvill during the period 1897–1899. There are also rich series of shells of the families Turridae (on which Sykes was an acknowledged authority), Mitridae and Marginellidae. It may also be noted that the marine shells include many items from the dredgings of Captain Townsend in the Arabian

Sea and Persian Gulf; these came into the possession of Sykes as gifts from his father-in-law, J. C. Melvill, who described the greater part of the Townsend Collections.

Blackbird feeding on *Arion subfuscus*.—On 21 May, near the goods shed at Southwell station, I observed a cock blackbird with an *Arion subfuscus* in its beak, which it carried to an ash path near the cattle dock. On alighting the bird dropped the slug, and rubbed its beak in the ashes to remove the slime. It then seized the slug in front of the mantle and dragged it head first through the ashes five or six times; a mixture of ashes and slime rolled up into a ball could be seen at the hind end of the slug. Owing to the viscid nature of the mollusc, the bird found it necessary to clean its beak of mucus and ashes. These operations were repeated again and again, until the slug was cleaned of slime. The bird then picked up the slug and beat and twisted it on the ground until it broke it up, whereupon it ate the skin and flew off with the viscera to a nest in a nearby hedge and fed its young.

G. W. PITCHFORD.

A Note on the Numbers of Snails.—So little is known of the numbers of snails in any area that perhaps the following observation may be of interest, although made in what is rather an artificial habitat. The main Birkenhead to Chester railway line was opened in 1840, and in the section between Bromborough and Spital station runs mostly in a shallow cutting with grass-grown sides bearing quite a varied flora. On 20 July 1949 a recently burnt part of the cutting was examined, and all the dead shells were collected over an area one yard square. They comprised: *Cochlicopa lubrica* (Müller), one; *Helix nemoralis* L., 6 adults, 6 young; *Discus rotundatus* (Müller), 21; *Oxychilus cellarius* (Müller), 9; and *O. alliarius* (Miller), 2. Another burnt-over area was examined in July 1954, this time in a maritime habitat, a bank once the old shoreline of the Dee estuary (Cheshire) and now separating a field from the top of the saltmarsh at Denhall Pt. Here some 50 ft. of bank had recently been burnt, leaving blackened brambles and some scattered hawthorns. Dead shells were fairly plentiful; several dozen *Helix aspersa* Müller were picked up in a short time, together with one *Helix nemoralis* L. and three *Oxychilus cellarius* (Müller). Snails being such slow-moving creatures the above figures probably represent fairly correctly the numbers of at least the larger species present.

N. F. MCMILLAN.

REVIEW.

An Introduction to Molluscan Ecology. Distribution and Population Studies of Fresh-water Molluscs. ALAN MOZLEY, D.Sc., Ph.D., F.R.S.E. Pp. x, 71; 15 text-figures (from photographs). London, H. K. Lewis and Co., Ltd., 1954. 9*s*.

DR. MOZLEY gives an excellent account of molluscan habitats and the ecology of freshwater snails in relation to parasitic diseases of man, especially Schistosomiasis. It is hard for Europeans to realize what a large proportion of the human race in the tropics, Egypt, China and Japan suffers from this disease. The photographs illustrate good and bad sites from the snails' standpoint, in temperate and tropical lands, and sites where a high snail population is close to a dense human one, these being the dangerous areas. A clear distinction is drawn between cheap short term, immediately applicable methods of control and long term fundamental research leading to complete elimination of the parasites. The laboratory worker breeding snails and studying the transmission of the parasites from snail to man, the taxonomist defining species, the field zoologist and botanist, and the sanitary inspector are all essential if this and similar scourges of man and domestic animals are to be overcome. The outlook is broadly based, including geographical, climatic and botanical considerations, chemical, biological and radiological possibilities, and man's ability to alter his immediate environment. The style is pleasing and direct and there is no padding.

Other books by the same author on molluscan host of parasites include *The Snail Hosts of Bilharzia in Africa*, *Molluscicides*, and *A Background for the Prevention of Bilharzia.*

H. E. QUICK.

FIELD MEETINGS.

Lullingstone, Kent, 22 May 1954. The purpose of the meeting was to explore the chalk downland scrub in Lullingstone Park. On arrival at Eynsford station the party inspected the site opposite the station entrance where *Helix pomatia* has been known for seventy years (J. W. Taylor, *Monograph* **3**, 231). Healthy examples were soon found in the hedge, but the site is already laid out for building plots. Fortunately the colony extends nearly half a mile northwards in the hedges. Along this same hedgerow is a numerous and variable colony of *Helix hortensis*, many of large size. At Lullingstone Park *H. pomatia* was very active, many shells still bearing a coating of soil after hibernation.

A. G. DAVIS.

Pangbourne, Berkshire, 13 June 1954. The weather was wet and cold, the Thames full and turbid, the ditch inaccessible on account of flood water, and the ground litter in the beech-wood too wet for satisfactory handling. Twenty-six species of land Mollusca were found, including a snail resembling *Hygromia liberta*, but it is desirable to collect and examine more material before recording this species for Berkshire.

H. E. QUICK.

Lewes, Sussex, 15 August 1954. Various meadow drains were examined near the remains of the Priory, primarily for *Valvata macrostoma.* The few specimens that were obtained came from the largest of the drains, which had recently been cleaned out, among an abundant population of *V. piscinalis*, on the small amount of weed that was left. *Bithynia tentaculata* was very common on the weed, and a rather small form of *Lymnaea peregra* crawling on the bottom mud. *Potamopyrgus jenkinsi* was present in fantastic numbers. Each of the small ditches, which were thickly overgrown with water plants, particularly *Lemna trisulca*, had a different proportion of the larger snails. In one *Lymnaea stagnalis* would be most abundant, in another *Planorbarius corneus*, in a third *B. tentaculata*, yet most of the ditches looked similar. Altogether 17 species of aquatic Mollusca were taken.

Time was also spent in examining the edge of the nearby road and field, where 18 species of Mollusca were found. Most noteworthy was a small colony of *Cochlicella acuta.* This is a new Sussex locality for this species, five and a half miles from the coast (about a mile further inland than the Saddlescombe locality, and half a mile further from the sea than the Burpham colony). There was also a fine colony of *Helicella virgata.*

P. COXHEAD.

Slines Oak and Greenhill Shaw, Surrey, 18 September 1954. From Chelsham the party proceeded by Slines Oak Road to Greenhill Shaw to explore the downland pasture and coppice. In the Shaw is a numerous colony of *Clausilia rolphii*, associated with the usual species to be expected in such a habitat. *Helix pomatia* was difficult to find, though abundant earlier in the summer, and *Helicigona lapicida*, seen a few weeks previously, was no longer in evidence. Single scalariform specimens of *Hygromia striolata* and *Helicella caperata* were picked up.

A. G. DAVIS.

East Horsley, Surrey, 3 October 1954. This was a repeat of visits in 1951 (*J. Conchol.* **23**, 282) to study the fauna of Sheep Leas, an area of calcareous pasture and woodland.

A. G. DAVIS.

Correction. In my presidential address I inadvertently misquoted Mr. A. T. Marston where, under the heading The Upper Middle Gravel (**23**, 357), I stated that the Swanscombe skull was discovered in this deposit. Mr. Marston has kindly written to say that the horizon of the Swanscombe skull antedated the infilling of the Middle Gravel Erosion Stage (i.e. the Channel) by the Upper Middle Gravels and Sands. See Marston, 1937, *J. Roy. Anthrop. Inst.* pp. 342, 344, 349 and 350, fig. 5, Layer 1 (letter i).

A. G. DAVIS.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

731st Meeting, held at the British Museum (Natural History), 24 April 1954.

The President in the chair.

Communication.

"The possible dispersal of *Pisidium* by Corixidae (Hemiptera)," by C. H. Fernando.

Exhibits.

Special exhibits : Strombidae, *Helicophanta.*

The President : Strombidae from Australia and Fiji ; *M. margaritifera* caught by rod and line by Lord Knutsford whilst salmon fishing in the River Spey.

Mr. C. P. Castell : Fossil Strombidae from the British Museum collections.

Mr. A. G. Davis : Sinistral *Acme fusca* (Montagu) from Bronze Age peat, Brook Vale, Northfleet, Kent; living *Helicodonta obvoluta* from Bepton Hanger, West Sussex, collected by H. Dixon Hewitt, September 1952, and a distribution map of the species in Sussex.

Mr. T. Pain : *Helicophanta* from Madagascar.

Mr. G. W. Pitchford : *Oliva* and *Olivella* from California and Mexico ; clausia of the British Clausiliidae ; living *Azeca goodalli* and *Helix pomatia* from Miserden Park, Glos.

Dr. H. E. Quick : Living *Achatina fulica* from Malaya ; living *Phytia myosotis* from Arun estuary, Sussex.

732nd Meeting, held at the British Museum (Natural History), 15 May 1954.

The President in the chair.

Members Deceased.

The President reported the deaths of Ernest Ruthven Sykes, elected a member of the Society in 1888, President 1899–1900 ; H. O. N. Shaw ; and G. H. Pavey Smith.

Member Elected.

John Francis Hayward, Ph.D., M.Sc., F.G.S., 29 Mount Echo Drive, Chingford, Essex.

Communication.

The Hon. Secretary gave a resumé of an article by D. Morris on "The Snail-eating behaviour of Thrushes and Blackbirds", *British Birds* **47**, 33–49.

Exhibits.

Special exhibits : *Haliotis* and Zonitidae.

The President : *Haliotis* from Australia and New Zealand ; British

Zonitidae ; " Catalogue of the Recent Mollusca of Canada," by Aurèle la Rocque (National Museum of Canada, Bulletin No. 129, 1953, $2.50).

Rev. H. E. J. Biggs : Zonitidae from Isles of Scilly.

Mr. C. P. Castell : Recent and fossil Zonitidae from the British Museum collections.

Mr. A. G. Davis : Dead shells of *Cochlicella acuta*, Bean-Greenhithe road and head of Bean valley, Kent, May 1954 ; shell of *Assiminea grayana* from a post-Roman or modern hill-wash, head of Bean valley (a few *C. acuta* were also present in this wash) ; *Truncatellina cylindrica* from Neolithic (Beaker Age) loam, south end of Greenhithe-Bean valley near Railway Hotel.

Mr. A. E. Ellis : British and Continental Zonitidae and *Vitrina*.

Mr. T. Pain : *Opisthostoma* from Borneo.

Mr. G. W. Pitchford : *Oxychilus draparnaldi*, Santa Cruz, California, collected by Dr. W. O. Gregg.

Mr. G. L. Wilkins : *Haliotis midae* and *H. varia* showing growth stages, from the British Museum collections.

733rd Meeting, held at the British Museum (Natural History), 16 October 1954.

The President in the chair.

Member Elected.

Miss Virginia Adam, Barnards Green House, Great Malvern, Worcs.

Communications.

" *Helix pomatia* L. with abnormal genital ducts," by H. E. Quick.

" New locality for *Hygromia limbata* (Draparnaud)," by L. W. Stratton.

The President also gave an account of a recent visit to Malham Tarn, Yorkshire.

Exhibits.

The President : Mollusca from Malham Tarn and land snails from near Kingskerswell, South Devon ; Australasian Turbinidae.

Mrs. M. Ainsley : land shells from St. Austell, Cornwall.

Mr. G. A. S. Barnacle : *Zonitoides excavatus*, Sandgate, Storrington, Sussex.

Mr. C. P. Castell : fossil *Turbo* and *Sphaerium* from the British Museum collections.

Mr. A. G. Davis : *Limax cinereoniger*, Titsey, Surrey ; shells from 3rd century Roman well, Chew Magna, Somerset.

Mr. M. P. Kerney : scalariform *Hygromia striolata*, Warlingham, Surrey ; *Vertigo alpestris* (Holocene), Millpark, King's Co., Ireland.

Mr. T. Pain : Odontostominae, South America.

Mr. G. W. Pitchford : living *Succinea oblonga*, Meathop Fell, Lancs. ; photographs of *Helix pomatia* taken in Miserden Park, Glos., by J. Armitage.

Dr. H. E. Quick : *Arion* ? *ater* 6½ inches long, from a garden in Kensington.

Mr. G. L. Wilkins : *Turbo jourdani*, Australia.

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CONTENTS.

PAGE

Obituary: J. R. le B. Tomlin 29
Coalfish feeding on *Patina pellucida*—R. RENDALL . . 39
Mya arenaria in Orkney—R. RENDALL 39
Acanthinula lamellata in a Holocene tufa at Totland, Isle of Wight—A. G. DAVIS 40
Snails preyed upon by Jays and Magpies—G. W. PITCHFORD . 40
Clausilia dubia in the Malham area—L. W. STRATTON . . 41
Dreissena polymorpha in a closed pond—G. W. PITCHFORD . 46
Notes on four Quaternary deposits in the Cambridge region—B. W. SPARKS 47
Planorbis laevis in Surrey—M. P. KERNEY 54
Helix nemoralis in a calcium deficient habitat—G. W. PITCHFORD 54
On the former occurrence of *Vertigo parcedentata* in Hertfordshire—M. P. KERNEY 55
Roebuck's papers on Scottish non-marine Mollusca—W. & M. RUSSELL HUNTER 59
Truncatellina cylindrica britannica in Dorset and Isle of Wight—A. G. DAVIS 61
Lauria anglica at Meathop Fell, Westmorland—G. W. PITCHFORD 62
The range of *Planorbarius corneus* in the British Isles—N. F. McMILLAN 63
Proceedings: 20 Nov., 18 Dec. 1954; 15 Jan., 19 Feb. (Annual Meeting) 1955 65
Changes of Address 70
Accounts 71
PLATE 2

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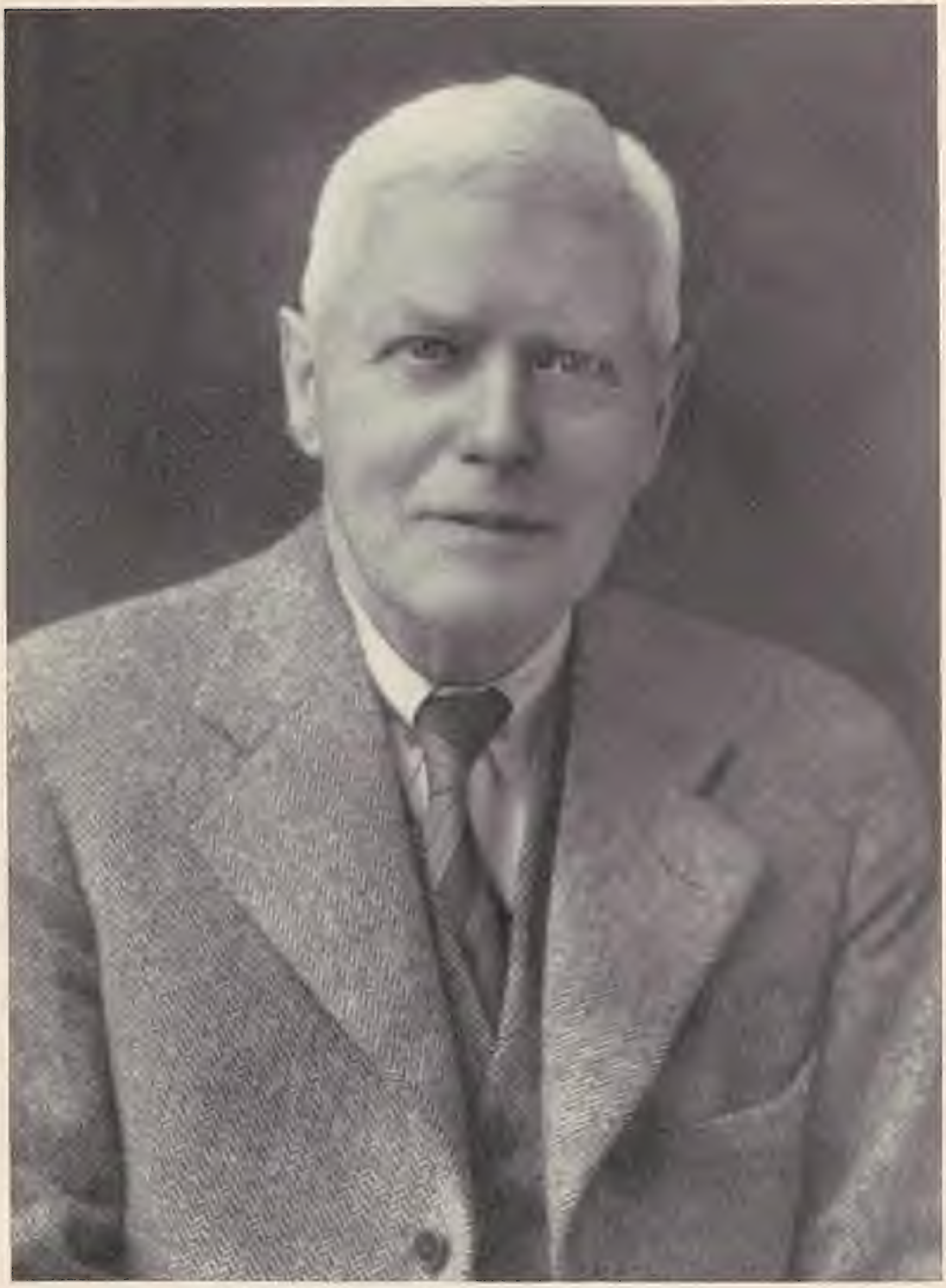

J. R. le B. Tomlin

[*To face p.* 29

THE

JOURNAL OF CONCHOLOGY

VOL. 24 14 JUNE, 1955. NO. 2

OBITUARY.

J. R. LE B. TOMLIN, 1864–1954.

AT 3 o'clock in the morning of Christmas Eve ended the long life of one of our oldest members, by the death at the age of ninety of John Read le Brockton Tomlin, who celebrated his last birthday anniversary on 15 August, when Mr. and Mrs. Tomlin's domestic staff organized a tea party in celebration of the occasion, which gave him great delight.

Born in 1864 at Stokefield, Elston, Nottinghamshire, he was the eldest son of John Read Tomlin (b. 1816) and Sarah Elizabeth (b. 1837), daughter of the Rev. Samuel May Lund, vicar of Awsworth, Nottinghamshire, and Martha Lund (née Pettinger). Tomlin lost his father at the early age of seven, and well remembered the strong impression made upon his young mind when he attended the funeral and followed the cortège to the grave. The family did not remain long in Nottinghamshire after his father's death in 1871, but moved almost immediately to Chester, his mother having a sister and brother-in-law, Hugh Falloon, vicar of Boughton, living there. Between seven and eleven years old he first had three successive governesses, and then in 1875 went to Arnold House School, Chester. In 1878 he won a scholarship (worth about £120) which took him to Winchester as a " collegiate ", one of fifteen of that year, whose names he always remembered, rolling them off to the writer only a month or two before his death. Whilst at Winchester he took an active part in the College Natural History Society and his first paper appeared in their magazine in 1882 (*Winchester College Nat. Hist. Soc. 6th Report*).

It is here interesting to recall that Tomlin's nickname at school was " Lucky Dog ", an apt sobriquet, for good luck accompanied him through his life in acquiring specimens by gift, purchase and exchange, as well as when collecting and indeed as regards other matters.

In 1883 he won a senior classical scholarship to Pembroke College, Cambridge. At Pembroke he met the writer's future headmaster and his brother. At the University he read classics, to which he added Sanskrit, taking his B.A. degree in 1886, class 2, 1st Division classical tripos. The College offered a scholarship for a fourth year on the strength of his degree and he took a place at the top of the 2nd class, but from lack of funds did not proceed to his M.A. till much later.

Whilst at Cambridge he met the Rev. Professor Gwatkin and the Rev. A. H. Cooke (author of the " Molluscs " section of volume 3 of the

Cambridge Natural History, Tutor of King's College, and in charge of the collections at the Sedgwick Museum), and it was from these men that Tomlin acquired or augmented his love of natural history, especially Mollusca, and started to form his magnificent collection of shells. Whilst at Cambridge he was in great demand for many of the social functions, including dances, at which Mrs. Gwatkin was a leading light, and Tomlin tells that it was owing to these dances that he took up dancing lessons. Professor Gwatkin, who for many years had visited the Channel Islands, mainly for the purpose of studying the anatomy and especially the radulae of Mollusca, introduced Tomlin, while still at Cambridge, to his hosts in Guernsey. Tomlin made a practice of spending some time of most of the next fifty years with the same hosts, adding to his collections, in which he was energetically assisted, after his marriage, by Mrs. Tomlin.

On going down from Cambridge, Tomlin coached pupils in Liverpool for a time, being near his home, and there he met F. P. Marrat, at one time of the Museum at Liverpool, who lived in Tunnel Road where Tomlin often visited him, and through whose association Tomlin was greatly helped in his review of Marrat's *Nassa* of the Liverpool Museum collections. H. S. Gorman, an enthusiastic coleopterist, was another friend. He rented a whole house in which to keep his world-wide collection, and it was his friendship which led to Tomlin giving still further study to this group of insects, on which he became an acknowledged authority, forming one of the best (if not the best) collection in existence of British Beetles, only a very few species of which remain unrepresented among the 82,000 specimens which some years ago Tomlin presented to the National Museum of Wales at Cardiff.

Yet other friends at Liverpool were the members of the Archer family, the two brothers, Francis and Samuel, being both interested in Mollusca. Samuel, a Colonel Surgeon, was Deputy Surgeon-General to the forces stationed at Singapore, where he collected assiduously, sending barrels of specimens home to his brother, Tomlin coming in for samples of species as he might desire for his collection, and at the Archers' death for a cabinet or two of shells.

Tomlin left Liverpool in 1890 to take up the appointment of senior assistant master at Llandaff Cathedral School, where he remained for nine years, during which time he made numerous friends in and around Cardiff and met other well known personalities who visited the notable Dean Vaughan of Llandaff, who was also Master of the Temple. At the Deanery Tomlin was *persona grata*, being regularly called upon to take a hand at one of the tables for a game of whist, besides at other times being a frequent visitor there. He of course met the Dean's two brothers when they stayed at the Deanery, one of whom was the Rev. Canon E. T. Vaughan, the first rector of Harpenden, Hertfordshire, where the writer of these notes lived as a boy, the other being General Vaughan. Many are the yarns told by Tomlin of the famous Dean and his " doves ", as the young men who stayed at Llandaff and read for the ministry under the Dean's guidance were known.

Llandaff being in fact a suburb of Cardiff, Tomlin's inclinations took him frequently to the Museum there, where the staff and he became of mutual assistance to one another, Dr. W. E. Hoyle, an old friend from Manchester Museum, being at one time in charge there.

Leaving Llandaff in 1899, Tomlin accepted an appointment as senior assistant master at Stancliffe Hall School, Darley Dale, Matlock, where he remained until 1902. About this time several relations died, leaving Tomlin among the beneficiaries under their wills, and he felt he was now able to devote more time to his beloved natural history interests and to his collections, visiting out of the way localities alone or accompanied by other kindred spirits. Among his coleopterist friends was Sir Thomas Hudson Beare, author of " A Catalogue of known species of Coleoptera of the British Isles ", with which Tomlin helped to some considerable extent, visiting various places with Hudson Beare. One particular hunt was on the Island of Mull to search especially for a rarity which they found in due course. This acquaintance formed yet another link between the writer and Tomlin, Hudson Beare being the writer's Professor of Engineering at University College, London, and afterwards Regius Professor at Edinburgh. Still another of Tomlin's coleopterist friends was Dr. W. E. Sharpe, who used frequently to accompany us to lunch when at the British Museum.

Visits to Guernsey were continued with Professor Gwatkin, and then in 1901, during his summer vacation, he joined a conducted tour in the Mediterranean. At each port of call he set forth collecting assiduously and calling on and making friends with local conchologists, one of whom was the Marquess di Monterosato, with whom Tomlin afterwards frequently corresponded. It was on this tour that he met his future wife, whose father, Mr. Theodore Kensington, was a master at Winchester. Correspondence followed and in 1906 Mr. Kensington's younger daughter, Eleanor Marjorie, and " Jack " Tomlin were married, a most happy culmination to a " shipmate " romance. The writer has been privileged to share their companionship on many occasions during a number of years, often accompanying both on collecting expeditions.

An annual visit of ours for some ten years or so was to Herefordshire, with a view to collecting and adding to records for the county for the " Catalogue of the Coleoptera of Herefordshire ", which was published in two parts by the Woolhope Naturalists' Field Club a few years ago. One of the favourite objectives was Moccas deer park, where Sir Geoffrey Cornwall gave us permission to roam at will, provided we let the head keeper know when we were there, so that we might not get shot if they were wanting to thin out the deer ! Our hunt for Coleoptera was of course interspersed with search for snails, both in Herefordshire and on our way there and back. We usually travelled by car, so that we could stop wherever we wished and examine any likely ground. I well remember on our first visit to the county one morning in the early autumn at Weobley, Tomlin would not budge from the place although I tried to hurry him, as we had planned to go a somewhat long drive, until, as I found the reason to be, he had sent a telegram to his gracious lady conveying birthday greetings, and so it was that one learned the date of the festival. This thoughtfulness for others was by no means confined to his own, and I know of a number of instances when both Mr. and Mrs. Tomlin have held out a helping hand to others in a less fortunate situation, and have seen Tomlin's blue eyes sparkle with pleasure when able to give someone a pleasant surprise. Deserving institutions came in for benefits, and among those dear to the heart of both was the National Lifeboat Institution.

After his marriage Mr. and Mrs. Tomlin went to reside at Reading, where I first met him. Frequently he and Mr. R. Winckworth would spend the night, after a meeting of the Malacological Society, at my house in Ealing, and after a meal often discussed subjects of mutual interest over a pint (or maybe more), sometimes into the early hours of the morning. About this time, too, Tomlin acquired the Molluscan collection of J. Cosmo Melvill. In 1916 he was asked by the authorities of the British Museum (Natural History) to assist in the department of Mollusca, which he did until well into 1948, when his doctor advised that he should take things more easily and should not make the long journey to town and back, the Tomlins having moved in the meantime to St. Leonards-on-Sea.

To celebrate the attainment of his 80th birthday a number of his friends assembled at the Piccadilly Hotel and gave a luncheon in his honour, at which function he was present, full of vigour and good health.

Not only did Tomlin add the very large Melvill collection to that of his own very extensive one, but he purchased several others, large and small, for instance the Bavay collection of Pectens, on which Bavay specialized. The great part of the collection of Col. Beddome, which passed through the hands of Messrs. Sowerby and Fulton, and which included a vast amount of Clausiliidae, a great deal of which Tomlin did not require, with his duplicates of other groups, he sold to me, and I must say that I came off best, the low price asked often making such a purchase in the nature of a gift.

J. T. Marshall passed on his collections and notes to Tomlin, and Marshall's annotated copy of Jeffreys' *British Conchology* was ultimately given by Tomlin (later also many other books) to the Molluscan library at the British Museum. Another very fine and most useful collection was that which passed into his hands from Dr. H. K. Jordan and which is very rich in series of specimens showing growth stages from the embryos upwards. Dr. Jordan, incidentally, was like Tomlin very interested in the National Museum of Wales, where I suppose Tomlin first became acquainted with him. Tomlin acquired numerous other local faunal collections such as that of New Zealand marine Mollusca, which he obtained by purchase not so long ago. All these collections were given to the National Museum of Wales, including that of Coleoptera before mentioned. The Court of Governors sent a deputation to St. Leonards to thank Tomlin for his magnificent gifts, and to acquaint him with his election as a Life Governor of the Museum in recognition of his generosity.

For years Tomlin worked on the compilation of a card catalogue of molluscan generic and subgeneric names, with references and types wherever possible, which catalogue is now in the library of the Molluscan Department at the British Museum. It was from this catalogue that the names of molluscan genera and subgenera were extracted and published in Neave's *New Nomenclator*.

Tomlin was a founder member of the Malacological Society of London, of which he was President from 1916 to 1919, and on attaining his 80th birthday was elected to Honorary Membership. In 1886 he became a life member of the Conchological Society, of which he was President from October 1920 to October 1921, and for a second term from December 1948 to December 1949. On his 80th birthday he was elected an Honorary member of this Society also, when he retired from over forty years' service as Editor of the *Journal of Conchology* (see vol. 23, p. 1). Tomlin was a life member of the Belgian Société Royale Zoologique and of the Société Linnienne de Lyon. For some years he was a member of the Malacological Society of Japan. He was also a Fellow of the Royal Entomological Society, to the Proceedings of which he contributed several papers, and a member and recorder of the Société Guernesiase.

The funeral took place on 29 December at the Crematorium Chapel at Charing, Kent, where the ashes were scattered in the lovely garden of remembrance.

Mrs. Tomlin survives her late husband, and has the affectionate help of two devoted maids in her home at 23 Boscobel Road, St. Leonards, where they have lived for so many years, and where so many of like interests to Mr. Tomlin have enjoyed and benefited from the unrestricted use of his famous collections. This privilege and the many kindnesses of the late owner will be ever remembered.

The list of new names of Mollusca proposed by Tomlin which follows was prepared by Mr. H. O. Ricketts of the British Museum (Natural History), and in the Proceedings of the Malacological Society of London will be found a bibliography of Tomlin's writings dealing with the Mollusca.

A. E. SALISBURY.

LIST OF NEW MOLLUSCAN NAMES PROPOSED BY J. R. LE B. TOMLIN

MR. J. R. LE B. TOMLIN wrote at least 320 papers and notes in various journals on Mollusca, but unfortunately never kept a record of the new names proposed by himself. The following list has been compiled from the large number of contributions he made to Conchology, and every effort has been made to make it as complete as possible.

The following abbreviations have been used :

A.N.M. (Annals of the Natal Museum).
A.S.A.M. (Annals of the South African Museum).
B.A.N.Z.A.R.E. (British Australian New Zealand Antarctic Research Expedition).
J.C. (Journal of Conchology).
P.M.S. (Proceedings of the Malacological Society of London).
gen. t. (type species of the genus).

New Families

ABYSSOCHRYSIDAE	A.S.A.M. **25** (1927), 77
COLUMBARIIDAE	A.S.A.M. **25** (1928), 330.

New Genera

Abyssochrysos	gen.t. :	*A. melanioides* sp.n. ; A.S.A.M. **25** (1927), 78.
Afritrophon	,, ,,	*Trophon kowieensis* Sow. ; J.C. **22** (1947), 271.
Afrivoluta	,, ,,	*A. pringlei* sp.n. ; J.C. **22** (1947), 245.
Alexandria	,, ,,	*A. natalensis* sp.n. ; A.N.M. **5** (1926), 287.
Callisteuma	,, ,,	*C. theleterium* sp.n. ; P.M.S. **18** (1929), 264.
Charitodoron	,, ,,	*C. euphrosyne* sp.n. ; A.S.A.M. **30** (1932), 162.
Eorrhachis	,, ,,	*E. sulphurea* sp.n. ; P.M.S. **19** (1930), 153.
Perlisia	,, ,,	*P. tweediei* sp.n. ; P.M.S. **27** (1948), 225.
Platymma	,, ,,	*Hemiplecta floweri* Smith, var. ; P.M.S. **23** (1938), 116.
Rhodinoliotia	,, ,,	*Cyclostrema roseotincta* Smith ; J.C. **14** (1915), 267.
Seilopsis	,, ,,	*Cerithiopsis ? peilei* Smith ; A.N.M. **6** (1931), 424.
Tropidorissoia	,, ,,	*T. taphrodes* sp.n. ; J.C. **14** (1915), 307.

New Sub-genus

Afrocardium type : *A. shepstonense* sp.n. ; A.N.M. **6** (1931), 449.

New Variety

nigromaculata, Columbella misera Sow. ; J.C. **14** (1915), 363.

Designated Genotype

Nevillia gen.t. : *Nevillia picta* H. Adams ; J.C. **21** (1938), 79.

New Species

africana, Pleurotomaria.	J.C. **23** (1928), 2.
africana, Machrochisma.	A.S.A.M. **30** (1932), 161.
africanus, Megatebennus.	A.N.M. **5** (1926), 296.
aglaia, Charitodoron.	A.S.A.M. **30** (1932), 169.
agulhasensis, Fasciolaria.	A.S.A.M. **30** (1932), 157.
alboguttata, Viriola.	A.N.M. **5** (1926), 294.
alexandri, Cerithium.	J.C. **17** (1923), 48.
alexandri, Priotrochus.	A.N.M. **5** (1926), 295.
alexandri, Triphora.	A.N.M. **6** (1931), 425.
algoensis, Fusitriton.	J.C. **22** (1947), 245.
anneae, Siphonaria.	J.C. **22** (1944), 92.
aphanacme, Marginella.	J.C. **15** (1918), 306.
aphanospira, Marginella.	J.C. **14** (1913), 101.
apicibulbus, Columbella.	J.C. **16** (1920), 87.
atractus, Marginella.	J.C. **15** (1918), 306.
atricatena, Clanculus.	J.C. **16** (1921), 216.
aulacodes, Eudolium.	A.S.A.M. **25** (1927), 83.
aureozona, Natica.	J.C. **16** (1921), 217.
balingensis, Alycaeus.	P.M.S. **27** (1948), 224.
balingensis, Odontartemon.	P.M.S. **27** (1948), 224.
barnaclei, Tortulosa.	P.M.S. **18** (1929), 152.
barnardi, Parmaphorella.	A.S.A.M. **30** (1932), 164.
bistriata, Cylichnella.	J.C. **16** (1920), 87.
booceras, Cadulus.	A.N.M. **5** (1926), 298.
boothi, Buliminus (Cerastus).	J.C. **13** (1910), 54.
britannica, Tellina.	P.M.S. **21** (1934), 146.
capense, Dentalium (Compressidens).	A.S.A.M. **29** (1931), 340.
capensis, Calyptraea.	A.N.M. **6** (1931), 428.
capensis, Glypteuthria.	A.S.A.M. **30** (1932), 165.
capensis, Latiaxis.	A.S.A.M. **25** (1928), 332.

chalmersi, Marginella.	J.C. **13** (1912), 320.
charasense, Opisthostoma.	P.M.S. **27** (1948), 225.
chatasensis, Sinoennea.	J.C. **21** (1941), 319.
chintamanensis, Sinoennea.	J.C. **21** (1941), 320.
chrysotoxa, Turritella.	A.S.A.M. **20** (1925), 315.
connollyi, Cecilioides.	J.C. **22** (1943), 23.
connollyi, Glycymeris.	A.N.M. **5** (1926), 299.
chupingense, Rhiostoma.	J.C. **21** (1938), 73.
corallinaceus, Vermetus (*Stoa*).	J.C. **21** (1939), 145.
cycloma, Liotina.	J.C. **15** (1918), 305.
cypriotes, Levantina.	P.M.S. **24** (1940), 32.
dautzenbergi, Marginella.	J.C. **13** (1912), 319.
diauges, Leiostraca.	J.C. **14** (1915), 308.
durbanensis, Microsetia.	J.C. **15** (1916), 119.
epipolia, Marginella.	J.C. **16** (1921), 216.
errorum, Ancilla.	J.C. **16** (1921), 216.
eumitus, Conus.	A.N.M. **5** (1926), 288.
euphrosyne, Charitodoron.	A.S.A.M. **30** (1932), 167.
eutornus, Cryptodon.	J.C. **16** (1921), 215.
eveleighi, Marginella.	J.C. **14** (1913), 11.
featheri, Buliminus (*Cerastus*).	J.C. **13** (1910), 54.
formosissimum, Columbarium.	A.S.A.M. **25** (1928), 331.
gabrieli, Succinea.	P.M.S. **20** (1932), 99.
gatliffi, Clanculus.	P.M.S. **16** (1924), 24.
greeni, Albinaria.	J.C. **20** (1935), 164.
hartleyi, Tortulosa.	P.M.S. **18** (1929), 152.
hemileuca, Triphora.	A.N.M. **6** (1931), 426.
hewitti, Antimitra ?	J.C. **16** (1921), 156.
ithychila, Marginella.	J.C. **15** (1918), 306.
jeffreysiensis, Rissoina (*Zebinella*).	A.N.M. **6** (1931), 422.
johorensis, Oospira.	J.C. **21** (1939), 147.
kakiense, Opisthostoma.	P.M.S. **27** (1948), 225.
kanchingensis, Sinoennea.	P.M.S. **27** (1948), 224.
kawtaoensis, Sarika.	Journ. Siam. Soc. Nat. Hist. Suppl. **8** (1929), 15.
kincaidi, Columbella.	A.N.M. **5** (1926), 292.
latisinuata, Euthymia.	A.N.M. **6** (1931), 426.
lembingensis, Sinoennea.	J.C. **21** (1941), 319.
lenggongensis, Diplommatina (*Sinica*).	J.C. **21** (1941), 319.
lenggongensis, Sinoennea.	J.C. **21** (1939), 146.
leucophaes, Mucronalia.	J.C. **14** (1913), 43.
leucophanes, Rissoina.	A.N.M. **6** (1931), 421.
libbahensis, Buliminus (*Zebrina*).	J.C. **13** (1910), 56.
liparozona, Marginella.	J.C. **14** (1913), 43.
lis, Zebina.	J.C. **15** (1918), 305.
macquariensis, Eumetula.	B.A.N.Z.A.R.E. Rep., Ser. B, **5** (1948), 227.
mcclelandi, Clementia.	J.C., **16** (1921), 215.
megaloprepes, Maurea (*Mucrinops*).	B.A.N.Z.A.R.E. Rep., Ser. B, **5** (1948), 225.
melanioides, Abyssochrysos.	A.S.A.M. **25** (1927), 78.
melvilli, Marginella.	J.C. **14** (1913), 11.
miltozona, Rissoina.	J.C. **14** (1915), 321.
mosselense, Calliostoma.	Trans. Geol. Soc. South Africa **28** (1926), 81.
mosselensis, Latirus.	A.S.A.M. **30** (1932), 158.
natalense, Columbarium.	A.S.A.M. **25** (1928), 331.
natalensis, Alexandria.	A.N.M. **5** (1926), 287.
natalensis, Mitrella.	A.N.M. **5** (1926), 291.
orestias, Ennea.	J.C. **13** (1910), 55.
pachista, Marginella.	J.C. **14** (1913), 101.

pasithea, Charitodoron.	J.C. **22** (1943), 50.
peilei, Galeomma.	J.C. **16** (1921), 156.
petasus, Heliacus.	A.S.A.M. **25** (1928), 334.
pithus, Odostomia.	J.C. **14** (1915), 308.
platymma, Adeorbis.	J.C. **14** (1913), 42.
platypleurum, Dentalium (Fissidentalium).	A.S.A.M. **29** (1931), 339.
polyaulax, Diaula.	J.C. **17** (1923), 49.
polystephes, Peltatus.	P.M.S. **11** (1915), 319.
pringlei, Afrivoluta.	J.C. **22** (1947), 245.
pulchreclathrata, Emarginula.	A.S.A.M. **30** (1932), 162.
pyrgidium, Turbonilla.	J.C. **14** (1915), 309.
repertricis, Siliquaria.	B.A.N.Z.A.R.E. Rep., Ser. B, **5** (1948), 226.
retiaria, Pyrene.	A.N.M. **6** (1931), 436.
retrovertens, Opisthostoma.	J.C. **21** (1938), 73.
salisburyi, Turritella.	A.S.A.M. **20** (1925), 314.
salpinx, Dentalium (Fissidentalium)	A.S.A.M. **29** (1931), 338.
samuiense, Rhiostoma.	P.M.S. **19** (1931), 227.
separanda, Parviterebra.	J.C. **17** (1923), 43.
shepstonense, Fragum (Afrocardium).	A.N.M. **6** (1931), 449.
shepstonense, Teinostoma.	A.N.M. **5** (1926), 295.
shepstonensis, Cerithiopsis.	J.C. **17** (1923), 48.
shepstonensis, Pollia.	A.N.M. **5** (1926), 291.
sinistra, Diplommatina (Sinica).	J.C. **21** (1938), 74.
siputana, Diplommatina (Sinica).	J.C. **21** (1938), 74.
siputana, Sinoennea.	J.C. **21** (1938), 75.
solidissima, Glypteuthria.	A.S.A.M. **30** (1932), 166.
spelaeotes, Rhiostoma.	P.M.S. **19** (1931), 227.
splendidissima, Triviella.	A.S.A.M. **30** (1934), 477.
subterlineatum, Dentalium.	A.S.A.M. **29** (1931), 337.
sulphurea, Eorrhachis.	P.M.S. **19** (1930), 153.
taphrodes, Tropidorissoia.	J.C. **14** (1915), 307.
tenuistriata, Bullia.	J.C. **16** (1920), 87.
terae, Hypselostoma.	J.C. **21** (1939), 146.
thalia, Charitodoron.	A.S.A.M. **30** (1932), 169.
theleterium, Callisteuma.	P.M.S. **18** (1929), 264.
thomensis, Cerithiopsis.	P.M.S. **18** (1929), 264.
thomensis, Syrnola.	J.C. **14** (1915), 308.
trinitalis, Eurytellina.	J.C. **18** (1929), 310.
trinitalis, Laevicardium.	J.C. **18** (1929), 308.
tropidophora, Phasionella.	A.N.M. **6** (1931), 420.
tweediei, Perlisia.	P.M.S. **27** (1948), 225.
tweediei, Platymma.	P.M.S. **23** (1938), 116.
tweediei, Sinoennea.	J.C. **21** (1941), 320.
viaderi, Rissoina.	J.C. **21** (1939), 165.
walvisiana, Marginella.	J.C. **16** (1920), 88.
waterstoni, Anodonta.	J.C. **17** (1923), 68.
wilmanae, Siliquaria.	P.M.S. **13** (1918), 16.

NEW GENERIC NAMES

Allepithema = *Heteropoma* Möllendorff, 1894, *non* Benson, 1856. P.M.S. **19** (1930), 22.
Allomactra = *Heteromactra* Cossman, 1909. P.M.S. **19** (1931), 175.
Anomphalodes = *Anomphalus* D. & G., *non* Meek & Worthen, 1866. P.M.S. **18** (1929), 255.
Boycottia = *Donaldia* Perner, 1903. P.M.S. **19** (1931), 175.
Carapezzia = *Geyeria* Carapezza & Schopen, 1899. P.M.S. **19** (1930), 24.
Closteroides = *Reisia* Tomlin, 1929, *non* Handlirsch, 1909. P.M.S. **18** (1929), 258.
Coriandria = *Microsetia* Monterosato, 1884. J.C. **15** (1917), 221.

Costatofusus = *Costulofusus* Cossman, 1894, *non* Gregorio, 1894. P.M.S. **18** (1929), 255.
Cyrtodontula = *Whitella* Ulrich, 1890. P.M.S. **19** (1931), 175.
Diaphanoteuthis = *Leptoteuthis* Verrill, 1884. P.M.S. **19** (1931), 174.
Diatrypesis = *Trypetes* Tomlin, 1929. P.M.S. **18** (1929), 258.
Elegantarca = *Arcoptera* Bittner, 1895, *non* Heilprin, 1887. P.M.S. **19** (1930), 23.
Fallaciturris = *Turrispira* Pethö, 1906, *non* Conrad, 1866. P.M.S. **18** (1929), 256.
Foersteria = *Cryptaulus* Foerste, 1923, *non* Bavay, 1903. P.M.S. **18** (1929), 255.
Frigidilacuna = *Sublacuna* Thiele, 1912, *non* Cossman, 1899. P.M.S. **19** (1930), 23.
Fucinia = *Geyeria* Fucini, 1901. P.M.S. **19** (1930), 24.
Gigantaxis = *Gibbonsia* Bourguignat, 1889. P.M.S. **19** (1930), 23.
Goniasma = *Goniospira* Girty, 1915. P.M.S. **19** (1930), 23.
Gyliotrachela = *Gyliauchen* Pilsbry, 1917. P.M.S. **19** (1930), 24.
Hannaoceras = *Smithoceras* Hanna, 1924. P.M.S. **19** (1931), 174.
Harmeria = *Lacunopsis* Harmer, 1923. P.M.S. **19** (1931), 174.
Hypostrongyla = *Globulina* Wagner, 1905. P.M.S. **19** (1930), 24.
Moniliopsidea = *Moniliopsis* Cossman, 1918, *non* Conrad, 1865. P.M.S. **19** (1930), 22.
Minniopsis = *Neritaea* Andrussov, 1912. P.M.S. **19** (1930), 24.
Odontochasma = *Stomatodon* Benson, 1862, *non* Seeley, 1861. P.M.S. **19** (1930), 23.
Omphalocrypta = *Cryptomphalus* D. & G., *non* Charpentier, 1837. P.M.S. **18** (1929), 255.
Paratrochoides = *Paratrochus* Kittl, 1899, *non* Pilsbry, 1893. P.M.S. **18** (1929), 256.
Patelliscapha = *Scapha* Hedström, 1923, *non* Gray, 1847. P.M.S. **18** (1929), 256.
Pericylindrica = *Cylindrica* Simpson, 1900, *non* Clessin, 1882. P.M.S. **19** (1930), 23.
Plagigeyeria = *Geyeria* Wagner, 1914. P.M.S. **19** (1930), 24.
Platychelyne = *Platychilus* Wöhrmann & Koken, 1892. P.M.S. **19** (1931), 175.
Pleuropomatia = *Pleuropoma* Wagner, 1897, *non* Möllendorff, 1893. P.M.S. **18** (1929), 256.
Prisodontopsis = *Pseudavicula* Simpson, 1900. Nautilus **42** (1928), 66.
Pseudogardenia = *Schlüteria* Rollier, 1922. P.M.S. **19** (1930), 23.
Reisia = *Fusoidea* Reis, 1897, *non* Wöhrmann & Koken, 1892. P.M.S. **18** (1929), 256.
Schilderia = *Globulina* Cerulli-Irelli, 1911. P.M.S. **19** (1930), 24.
Sicania = *Trinacria* Boettger, 1877, *non* Meyer, 1868. P.M.S. **18** (1929), 256.
Toroteuthis = *Hyaloteuthis* Pfeffer, 1884. P.M.S. **19** (1931), 175.
Trypanocochlea = *Verania* Koken 1896. P.M.S. **19** (1931), 175.
Trypetes = *Terebrella* Andreae, 1887, *non* Maltzan. P.M.S. **18** (1929), 256.

New Specific Names

abyssorum, Marginella = *seminula* Dall, *non* Gould. J.C. **15** (1916), 43.
anadema, Conus = *fasciatus* Kiener, 1849, *non* Perry, 1811. P.M.S. **22** (1937), 206.
atractus, Conus = *fusiformis* Lamarck, 1810, *non* G. Fischer, 1807. P.M.S. **22** (1937), 206.
barnardi, Triphora = *capensis* Thiele, 1925. J.C. **22** (1945), 135.
bucca, Marginella = *ovulaeformis* Tate & May = *M. ventricosa* Hedley J.C. **15** (1916), 43.
chionia, Mactrinula = *complanata* Reeve. J.C. **16** (1921), 226.

climax, Conus = *scalaris* Martin, 1879, *non* Valenciennes, 1832. P.M.S. **22** (1937), 206.
cosmetus, Conus = *ornatus* Michelotti, 1847, *non Cucullus ornatus* Röding, 1798. P.M.S. **22** (1937), 206.
desmotus, Conus = *catenatus* G. B. Sowerby III, 1879, *non* G. B. Sowerby I, 1850. P.M.S. **22** (1937), 206.
elachistus, Conus = *exiguus* Eichwald, 1830, *non* Lamarck, 1810. P.M.S. **22** (1937), 206.
erythrogramma, Mitra = *Tiara lineata* Broderip, 1835. Nautilus **45** (1931), 54.
euschemon, Conus = *gracilis* Wood, 1828, *non* G. B. Sowerby I, 1823. P.M.S. **22** (1937), 206.
euzonus, Conus = *cinctus* Borson, 1820, *non* Bosc, 1801. P.M.S. **22** (1937), 206.
fracta, Marginella = *ventricosa* Hutton. J.C. **15** (1916), 43.
hopwoodi, Conus = *gracilis* G. B. Sowerby III, 1875. J.C. **20** (1936), 254.
hornelli, Cardium (Trachycardium) = *maculosum* Sowerby, *non* Wood. (= *pristipleura* Dall, 1900). J.C. **18** (1928), 194; see J.C. **19** (1931), 130.
hypochlorus, Conus = *croceus* Smith, 1877, *non* G. B. Sowerby II, 1833. P.M.S. **22** (1937), 206.
jordani, Diala = *capensis* Bartsch, 1915. J.C. **21** (1939), 159.
kowiensis, Alvania = *ima* Bartsch, 1915, *non* Bartsch 1911. A.N.M. **6** (1931), 421.
maduranus, Conus = *madurensis* Martin, 1906, *non* Brug., 1792. P.M.S. **22** (1937), 206.
melanozona, Engina = *Ricinula zonata* Reeve, 1846. Nautilus **42** (1928), 40.
mighelsi, Lienardia = *Pleurotoma rugosa* Mighels. J.C. **15** (1917), 216.
notatus, Conus = *lineatus* Borson, 1820, *non* Solander, 1766. P.M.S. 22 (1937), 206.
odhneri, Crassatella = *capensis* Odhner. J.C. **19** (1930), 35.
oligistus, Conus = *parvulus* Martin, 1879, *non* Link, 1807. P.M.S. **22** (1937), 206.
onchnodes, Conus = *piruloides* Douville, 1932, *non pyruloides* Sacco, 1894. P.M.S. **22** (1937), 206.
outis, Alvania = *nemo* Bartsch, 1915, *non* Bartsch, 1911. A.N.M. **6** (1931), 421.
phlogopus, Conus = *flammeus* Lamarck, 1810, *non Cucullus flammeus* Röding, 1798. P.M.S. **22** (1937), 206.
platyaulax, Venus = *latilirata* Sowerby. J.C. **17** (1924), 114.
polyaulax, Strigilla = *Tellina senegalensis* Hanley, *non* Gmel. J.C. **14** (1915), 276.
polygrammus, Conus = *multilineatus* G. B. Sowerby III, 1875, *non* Pecchiolo, 1864. P.M.S. **22** (1937), 206.
romeri, Pitaria = *Caryatis belcheri* Romer, *non* Sowerby. J.C. **14** (1913), 96.
schepmani, Marginella = *abyssicola* Schepman. P.M.S. **12** (1916), 64.
sculpturata, Glypteuthria = *capensis* Tomlin, 1932. J.C. **22** (1945), 135.
subrosalina, Venus = *affinis* Sowerby. J.C. **17** (1923), 8.
sumatrae, Conus = *sumatrensis* Haanstra & Spiker, 1932, *non* Brug., 1792. P.M.S. **22** (1937), 206.
tiarophorus, Conus = *tiaratus* Martin, 1931, *non* G. B. Sowerby II, 1833. P.M.S. **22** (1937), 206.
tmetus, Conus = *sulciferus* A. Adams, 1854, *non* Deshayes, 1835. P.M.S. **22** (1937), 206.
trigonicus, Conus = *triangularis* Finlay, 1924, *non berghausi* Michelotti v. *triangularis* Sacco, 1894. P.M.S. **22** (1937), 206.

tuberculosus, Conus = *tuberculatus* Yokoyama, 1920, *non* Dujardin, 1837. P.M.S. **22** (1937), 206.
tumidissima, Sunetta = *hians* (Reeve). J.C. **16** (1922), 312.
whydahensis, Obeliscus (*Syrnola*) = *Syrnola gracillima* Smith. J.C. **18** (1928), 272.

New Subspecific Name

timoranus, Conus orbignyi Aud. = *timorensis* Koperberg, 1931, *non* Brug., 1792. P.M.S. **22** (1937), 206.

New Varietal Names

asterope, Conus pyrula Broc. = v. *fulminans* Sacco, 1893, *non C. fulminans* Bronn, 1831. P.M.S. **22** (1937), 206.
daedalma, Conus eschewegi da Costa = v. *caelata* Sacco, 1894, *non C. caelatus* A.Ad., 1854. P.M.S. **22** (1937), 206.
fasciolata, Patella variabilis Krs. = v. *fasciata* Krauss, 1848, *non P. fasciata* Gmelin. A.N.M. **6** (1931), 418.
polygramma, Patella variabilis Krs. = v. *radiata* Krauss, 1848, *non P. radiata* Born. A.N.M. **6** (1931), 418.
syngenes, Conus dertovatus Sacco = v. *connectens* Sacco, 1894, *non C. connectens* A. Adams, 1855. P.M.S. **22** (1937), 206.

H. O. RICKETTS.

Coalfish feeding on *Patina pellucida*.—In the stomach of a coalfish (*Gadus virens* L.) caught off the shore at Birsay, Orkney, on 6 January 1955 I found dense masses of *Patina pellucida* (L.), as many as a dozen complete specimens in a fish about ten inches long, together with a few *Lacuna vincta* (Montagu). Shoals of coalfish come close inshore towards the end of summer and stay there throughout autumn and early winter. *P. pellucida* is evidently a staple article of their diet.

ROBERT RENDALL.

***Mya arenaria* in Orkney.**—On re-examining specimens of *Mya arenaria* L. taken in the tidal but almost freshwater Loch of Stenness, Orkney (*J. Conchol.* **23**, 8), and comparing them with those of similar size from the inner bay of Peter's Pool, Deerness, a shallow inlet of the sea extending a fair distance inland, I found that those from the brackish water at Stenness were much thinner and, though finely surfaced, duller in appearance ; the shells from salt water at Deerness were more solid with nacreous interiors.

ROBERT RENDALL.

ACANTHINULA LAMELLATA (JEFFREYS) IN A HOLOCENE TUFA AT TOTLAND, ISLE OF WIGHT.

By A. G. Davis, F.G.S.

(*Read before the Society*, 15 *January* 1955.)

The existence since the Pleistocene of this beautiful species south of the Thames, except in Kent, has not previously been reported. It occurs in some abundance in the grey and white tufa deposits at Totland, Isle of Wight. The deposits, which cap the cliff behind the old boathouse, were made known by Edward Forbes in 1856 (Tertiary fluvio-marine formation of the Isle of Wight, *Mem. Geol. Survey*, p. 8). Kennard and Warren redescribed the deposits and extended the faunal list (*Geol. Mag.* 1904, p. 19).

In April 1954 Mr. and Mrs. J. N. Carreck gave me samples they had collected from these deposits, amongst which I detected two broken examples of *Acanthinula lamellata.* On subsequently visiting the site I took larger samples, which yielded over fifty perfect specimens of *A. lamellata*, together with most of the associated species previously recorded. This occurrence marks the southern limit of the range of this N. European species. It has been recorded from a deposit of Pleistocene age, associated with *Corbicula fluminalis*, at West Wittering on the coast of Sussex (J. P. Johnson, 1901, *Proc. Geol. Assoc.* **17**, 18). In the southern part of England *A. lamellata* is at the present time restricted to a very few localities, but is still frequent in the north of England, in Scotland and in Ireland.

Snails preyed upon by Jays and Magpies.—Towards the end of July I observed a jay and two magpies collecting snails amongst the newly mown swaths of herbage along the railway between Upton Crossing, Southwell, Nottinghamshire, and Rolleston West junction. I was able to enter a fog-signalman's hut without disturbing the birds and get a close-up view of their movements through a hole in the wall. The birds were collecting *Helix nemoralis* and *Arianta arbustorum* indiscriminately. Their method of procedure was as follows: having alighted upon the herbage and picked up a snail, the bird would fly to the top of one of the wooden fence posts. The snail was almost invariably grasped between the toes of the left foot and the shell broken away by several jabs with the beak, the body being then immediately swallowed. This process was repeated again and again until the jay, having apparently satisfied its appetite, emitted a raucous call, whereupon the birds flew off to some trees by the river.

G. W. Pitchford.

(*Read before the Society*, 19 *March* 1955.)

CLAUSILIA DUBIA DRAPARNAUD IN THE MALHAM AREA.

By L. W. Stratton

(*Presidential Address, delivered at the Annual Meeting,* 19 *February* 1955.)

The snail variously known as *Clausilia dubia* Draparnaud, *Clausilia cravenensis* Taylor, and *Clausilia dubia* ss. *suttoni* Westerlund, was first discovered in Britain by J. Alder in 1830, and then recorded as a variety of *Clausilia bidentata* (Ström) (Kennard and Woodward, 1926). Records for Essex South, Herts, Oxford and Suffolk East are unconfirmed, and that for Northampton erroneous (Ellis, 1951). The Dover colony is said to be the true *C. dubia* of the Continent, and therefore different from our own, so that the species appears to be essentially northern, and its distribution has been worked out in detail by Blackburn (1940). The same author gives some notes on its habitats and environment, but deals mainly with the more northern localities. In June 1954 the opportunity occurred to study *Clausilia dubia suttoni* in the Malham area and, since this seems to be somewhere near its southern limit, some remarks upon it may prove to be of interest.

Blackburn comments upon the hardiness of the species, and quotes it as occurring on Ingleborough, 10½ miles from Malham Tarn, at 2,350 feet. This would be on the capping of Millstone Grit, but he specifically mentions instances of the occurrence on this rock elsewhere, so the record may be correct. On Penyghent, in September 1954, Mr. C. A. Sinker found it up to 2,000 feet, but not on the Millstone Grit above that height, neither does it occur on the capping of Fountains Fell, though it does on the limestone slopes. Blackburn also refers to large numbers found by Alkins (1928) in the Cartmel peninsula, where conditions are very favourable, and *C. dubia* lives with *C. bidentata* and *Marpessa laminata* (Montagu), but says that further north numbers are much smaller. With regard to its association with the other two species he says, " Usually where one is neither of the other two will be found." At Malham numbers are very variable, though it is abundant in some places, and, while *M. laminata*, a woodland and hedgerow species, does not occur there, *C. bidentata* does, and in nearly every instance in association with *C. dubia*.

Boycott (1934) seems to think the snail essentially calcicole, and sums up its habitats very satisfactorily by saying, " *C. cravenensis* . . . much extends its range and frequency by the walls : it lives otherwise only on natural calcareous rock except on the Durham coast, where it inhabits damp clayey banks on the sea cliff." This latter " exception to the rule " is worthy of remark, and refers to a note by Harrison (1931), who says that *C. dubia* is " common enough on damp clayey banks at Blackhall Rocks ; occurs with a very curious mixture of *Helix arbustorum* and *Succinea pfeifferi* ".

C. dubia has been recorded for the Malham area on a number of occasions, and Roebuck (1890) says, " *Clausilia dubia* var. *suttoni* Westerlund is very abundant at Gordale Scar ; abundant on limestone rocks at Malham ; abundant close to Malham Tarn House. On old walls, Malham Moor." This gives, very briefly, the kinds of habitats of the species in the area. Since all the walls are made of limestone, it would appear that there is a good deal of similarity in these habitats, as indeed there is, but there are also many differences which must affect the micro-climates.

Limestone rocks were examined at Malham Cove, Comb Scar, Malham Tarn House, Green Hill Scar on the slopes of Fountains Fell and Upper Gordale ; and walls in many places.

At Malham Cove a limestone cliff rises to a height of some 300 feet. At one time Malham Beck plunged over this cliff in a spectacular fall ; now another stream emerges at the foot of it. On either side of the beck loose screes rise against the cliff face, forming a flattened V. Plants and small trees grow in cracks on the cliff, and many nettles and other plants on the screes. *C. dubia* was found in fair numbers on the face above the line of ground flora, sometimes among small plants growing in the cracks. *Helix nemoralis* L. had begun to ascend the cliff behind the nettles, and lived plentifully with *Arianta arbustorum* (L.), a few *Helix hortensis* Müller and other smaller species, of which *Hygromia striolata* (C. Pfeiffer) were all of the white form. The finding of 15 specimens of *H. hortensis* there was particularly interesting, as only odd single specimens had previously been recorded for the whole area.

Comb Scar forms a gorge which deepens as it goes southward below Water Sinks, the place where Malham Beck now disappears underground. At the entrance vertical cliffs of no great height descend to the valley floor, but further south there are screes of loose limestone rocks with grass above and below, and here and there a patch of nettles. The floor of the gorge is dotted with limestone boulders of all sizes, many half buried. Generally the grass is kept short by sheep, cattle and rabbits, but round the boulders, where the animals cannot graze, it grows longer. Where the cliffs come right down to the valley floor grass and other plants grow to a foot or so ; nettles to 2 feet. The latter also grow in sheep shelters, which consist of stone walls some 5 feet high, in the form of a letter E, the open side towards the cliff. On a dry day a few *C. dubia* and *C. bidentata* may be seen in cracks on the cliff face, but the majority hide in the herbage at the base. On wet days they ascend the rocks in great numbers, though *C. bidentata* outnumbers *C. dubia* by about two to one. The latter, however, lives alone on the walls of the sheep fold, the lower stones of which are covered with the moss *Neckera crispa*. *Pyramidula rupestris* (Drap.) in great profusion, *Discus rotundatus* (Müller) and *L. cylindracea* (da Costa) live on the cliff face, but not on the walls. A few *Helix nemoralis*, all yellows, and several varieties of *Arianta arbustorum*, including the striking var. *canigonensis* Boubée, live among the nettles. Around the boulders on the valley floor *C. dubia* and *C. bidentata* hide in the grass with *Cochlicopa lubrica* (Müller), *Azeca goodalli* (Férussac) and *Vitrea crystallina* (Müller), crawling out on the rocks during and after rain.

During a heavy rainstorm, rivulets of water ran down the face of the cliff, and, when caught in these, *Clausilia* slipped and rolled about in the quaintest way. The water evidently washed away or diluted the mucus and loosened their grip, though none was actually seen to fall.

At Malham Tarn House, behind the Zoology Laboratory, is a limestone face varying from 7 to 10 feet high, and forming the verge of a wood which grows above it. The rock face runs irregularly for about 30 feet, then turns at right-angles for about 10 feet, and turns away at an obtuse angle behind the laboratory. For the first 40 feet the tree canopy is well above the top of the rock, but the last part is deeply shadowed by the building and tree branches. At the base of the rock is a thick ground layer of dog's mercury (*Mercurialis perennis*), varying from a foot wide to three or four in the right-angle. The first section has several long vertical cracks, and in dry weather a few *C. dubia* may be found in them, and more on the rock face after rain. The middle section is very smooth, with no cracks, faces a little south of south-east, and can get an hour or two of sunshine directly on it each day. On a dry evening, after nearly a week of dry, sunny weather, 39 *C. dubia* were counted on this rock face, from just above the dog's mercury to the top. During ten days of varying weather, at all times of the day, about the same number could be seen. In the third, shadowed section, very few were to be seen at any time, and it would seem that the snail does not like deep shade. This is borne out by the fact that, where the House drive runs through a deep gully formed by limestone rocks 8 to 12 feet high, deeply overshadowed by trees but otherwise an apparently suitable habitat, *C. dubia* does not occur at all.

On Green Hill Scar, at 1,400 feet, there is a partly buried limestone pavement. This is a flat mass of limestone broken up into roughly rectangular blocks (clints) by deep cracks or " grykes ". There is a perfectly exposed pavement above Malham Cove, but the one at Green Hill Scar has caused some controversy among botanists as to whether it is in the process of exposure or is gradually being buried. *C. dubia* occurs sparingly in the grykes, and more abundantly behind grass at the foot of the pavement's edge. Other molluscs present were *D. rotundatus*, *V. crystallina*, *L. cylindracea*, *P. rupestris* and *Oxychilus cellarius* (Müller), while *O. alliarius* (Miller), *Retinella nitidula* (Drap.) and *R. radiatula* (Alder) were found around isolated boulders. *C. dubia* probably occurs on Fountains Fell up to 1,900 feet, the line of the Millstone Grit. Mr. Sinker says, " I have seen *Clausilia* recently (24.9.54) on each of the Yoredale limestone beds up the south-east face of Penyghent (five miles from Malham Tarn), the highest at 2,000 feet, even where the outcrops were very small and isolated by moorland."

In Upper Gordale there is a jumbled mass of limestone outcrop on the valley floor with many half-buried outlying boulders. *C. dubia* and *C. bidentata* live abundantly on the main outcrop and on the nearer outliers, the latter species being probably slightly more numerous. Further away from the main mass, *C. dubia* decreases in number until only *C. bidentata* occurs, and then this finally dies out. The whole area is grazed by sheep, and the snails live in the longer grass round the outcrop and boulder sides, ascending in damp or wet weather. *C. lubrica* is the common associate, and is also found around erratics far from any outcrop, nearly every one of which has its one or two *Agriolimax reticulatus* (Müller).

The stone walls of the Malham area vary a good deal in height, thickness and the sizes of the stones of which they are made. According to their situation they may be completely or partially covered with moss, have moss on the lower one or two tiers of stones, or may be completely bare of moss. It is convenient to classify them as closed or open walls. The former are built of smaller stones which knit more closely together. The interstices become choked with debris, so that the wall is a practically solid structure, with moss on the faces and plants growing in the cracks and on top. Usually they are found close to human habitation, forming farm walls, garden walls and so on, and are often in more sheltered situations. On the exposed hillsides, walls are generally higher, up to 6 feet, thicker at the base than at the top and made of larger stones, so that it is often possible to see through the walls at many places. With the larger spaces between the stones, wind and rain keep them free from debris; the walls tend to be much drier and have little or no apparent vegetation, though there may be moss on the bottom stones. These may be called open walls and there are many gradations of them.

The first wall examined was a closed roadside wall near Malham Tarn House; it was about 3 feet high with a flat top. Rather long grass and one small patch of nettles grew at its base and harboured *Arion circumscriptus* Johnston and *Agriolimax reticulatus.* The lower stones were covered with the moss *Camptothecium sericeum* up to 12 to 18 inches. Lichens grew on the rest of the wall, with a few small plants in the cracks, while stonecrop (*Sedum acre*) and other plants grew on the top. On a dry evening, *C. dubia* was seen here and there in the cracks and the tips of others protruded from the moss. An occasional *P. rupestris* was also to be seen. On another day, at 1.30 p.m., after a morning of continuous rain, the wall was examined again, and in a space 2 feet wide 43 snails were counted, all *C. dubia*, nearly all on the "bare" stones; the few on the moss at the base were crawling upwards away from it, and some were also on the top of the wall. At one point the wall is slightly overshadowed by a tree, and it was most noticeable that the snails were fewer under it.

Some two miles north of Malham Tarn, in a valley near the junction of Cowside and Darnbrook Becks, lies Darnbrook House. North of this the hillside rises steeply to a long limestone outcrop. On the top, at the edge of this outcrop, is a high stone wall. It is built of large stones, loosely knit, with open spaces through which the wind whistles, and it is entirely bare of vegetation; it is probably the opposite extreme to the closed wall just described. Between the stones one or two *C. dubia* were seen, but on pulling away the long, uncropped grass around the basal stones, it was found to be plentiful, with *C. bidentata.* Here the two species appeared to live alone, though they were found in small numbers on the outcrop with *Hygromia striolata* and *A. reticulatus.* On the grazed sward below were many *H. nemoralis*, variously banded but all yellows.

South of Great Close is a small wood surrounded by a high wall, the lower stones of which are covered with the moss *Neckera crispa. C. dubia* was plentiful on this wall, but only on the outside, none living on the deeply shaded inside. No other snails were seen. Another open wall running south from Water Sinks Gate, past Water Sinks to join up with the eastern wall of Comb Scar, had *Neckera crispa* on the lowest tier of stones only. Here *C. dubia* occurred in small numbers at various places, with only *C. lubrica* as associate.

Many other walls were examined at Malham, on Malham Moor and in the Tarn area. The numbers of *C. dubia* varied considerably, from being plentiful on some walls to none at all on others. The run of the wall did not appear to affect its presence or absence; neither did a growth of moss seem necessary. On two walls only, both at Malham Village, was *C. bidentata* found alone.

The terms "bare rocks" and "bare stones" have been used, but in actual fact the rock faces and stones are not bare at all, but are covered with lichens, many so inconspicuous as to be unnoticed. Such obvious species as *Xanthoria parietina* and *Cladonia pixidata* are easily recognizable, but as many as 30 to 40 species may live on a small area of rock face.

Blackburn says of *C. dubia*, "It lives on lichen and minute fungi on walls and mosses." There is little doubt that the chief food is the lichens and possibly minute fungi, which grow on the rock faces and stones of walls. To obtain exact details would require prolonged study in the field and in the laboratory with the aid of an authority on British lichens, of whom there are very few. It was noticeable that, when the snails were moving about, and presumably feeding, they left all shelter. The only requirement seemed to be sufficient dampness, either on the feeding surface or in the atmosphere. The time of day did not matter. Whether any food was obtainable on the mosses is doubtful, as the snails crawled away from them when on the move. It appears much more likely that the mosses were used only for shelter. This is borne out by the fact that, on a wall entirely covered with moss, on the opposite side of the road to the closed wall first mentioned, close searching in all weathers failed to reveal a single *C. dubia* anywhere along its length. The growth of the moss had probably destroyed the lichens and, therefore, the feeding grounds.

A notable feature of the investigation was that *C. bidentata* did not occur on any wall on which there was a growth of moss. Whether this is invariably so in this area is not known. It certainly occurs on mosses on fallen tree trunks and in woods, though these may be of different species. The Malham area is particularly rich in lichens and mosses, and for comparison with other areas and habitats a short list of some of the commoner carpeting mosses of walls may be useful: *Bryum capillare*, *Camptothecium sericeum*, *Ctenidium molluscum*, *Grimmia apocarpa*, *Hypnum cupressiforme*, *Nekera complanata*, *N. crispa*, *Tortella tortuosa*, *Tortula ruralis*.

Blackburn comments on the strigillation to be seen on some specimens of *C. dubia*. It was certainly present on some of the shells taken at Malham. A more noticeable feature was that the majority of the shells had a whitish appearance, the same colour as the limestone, but the undersides of the shells, i.e. the sides nearest the rock when crawling, were the normal colour. Moreover, a great deal of this whiteness came off in boiling. It was undoubtedly dust from the rock, and certainly rendered the snails less conspicuous.

To sum up, it would seem that the habits of *C. dubia* are much the same in all types of habitats in this area. The cause or causes of the variability in numbers is not at present apparent. Its association with *C. bidentata* appears to be general, except on mossed walls, though the presence of other species seems to be entirely adventitious. For purposes of comparison, the habitats of this snail in other areas, and particularly in its few localities in Scotland, are worthy of study.

Thanks are due to the Ministry of Education and Mr. L. C. Johnson, H.M.I., for facilities to conduct this investigation ; to the wardens at the Malham Tarn Field Centre, Mr. P. F. Holmes and Mr. C. A. Sinker, for their interest and help with information and photographs ; to Mr. Sinker for the identification of mosses and lichens ; and to fellow " students " who helped with the snailing.

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***Dreissena polymorpha* (Pallas) in a closed pond.**—Situated nearly midway between Trent station, Derbyshire, and the Grand Union Canal at its junction with the River Trent at Trentlock, is a gravel-pit known as Fletcher's Pond. The water in this pond is always crystal clear, aquatic plants, fish and other forms of life being clearly visible. *Lymnaea auricularia* (L.) is quite common, and dwarfed *Anodonta anatina* (L.). The posterior portion of the shells of the latter are usually covered with *Dreissena polymorpha*, which also occurs in abundance on stones and the rhizomes of yellow flag (*Iris pseudacorus*), reminding one of mussel beds on the seashore. When fully grown these *Dreissena* attain only about half the size of those found in the Nottingham canal. I am convinced that it is the *Dreissena* that keep the water so clear. Having kept them in captivity for many months, I found out how quickly they clear the water of algae. I used to fetch water, which was deep green in colour, from a disused cattle trough, but within twelve hours the *Dreissena* would make this as clear as tap water.

G. W. PITCHFORD.

(*Read before the Society*, 19 *March* 1955.)

NOTES ON FOUR QUATERNARY DEPOSITS IN THE CAMBRIDGE REGION.

By B. W. Sparks.

(*Read before the Society*, 19 *March* 1955.)

In the course of recent investigations around Cambridge four Quaternary deposits containing molluscan faunas have been discovered: three of these are of Holocene age and one of Pleistocene age.

(1) Bordeaux Pit, Little Chesterford, Essex (Grid Ref. 513413).

This pit, which lies half a mile south of Bordeaux Farm, Little Chesterford, 12 miles S.S.E. of Cambridge, is a well known Pleistocene deposit. The pit was worked earlier in the century and described by Marr (1926). It was reopened and greatly extended in 1951 and closed again in 1952.

The pit exposes up to 25 feet of bedded and unbedded gravel, while in one place in the northern part of the pit a tongue of boulder clay extending across the pit occurs at about the level of the water table, i.e. about 20 feet below the top of the face adjoining the railway (Fig. A). At approximately the level of the floor of the pit the gravel appears to be fairly well bedded, but above this it varies considerably. Along the face ABCD (Fig. A) it is mainly a rubble gravel with one seam of loam (1–2 feet in thickness) at a depth of about 5 feet (Fig. B), while along the face MN there are about 10 feet of false bedded sand, gravel and loam below about 10 feet of stony loam (Fig. C). Along the face MLKJ the lower false bedded material of the face MN changes laterally into rubbly gravel, and it appears that the lithological changes in the gravel are indicative only of local variations from stream to solifluxion material.

Mollusca were found in both the fairly well bedded gravel on the floor of the pit and also in the variable gravel above. In the former, patches of fossiliferous material were found at X and Y (Fig. A), and the shells from these places are listed below with those recorded by Kennard and Woodward in the appendix to Marr's paper (1926). Although Marr appears to have been uncertain of the horizon from which the shells came, a note on some of the specimens, now in the Sedgwick Museum, to the effect that they were taken from a depth of 30 feet, makes it likely that they came from the same bed.

At the same level as these shells, at the point indicated on the map, were found three teeth and a tusk of a mammoth, while Marr also recorded mammoth and woolly rhinoceros from the same level.

The shells are all of hardy species with the possible exception of *H. itala*, but this has been recorded before in association with cold faunas (e.g. Kennard 1924, Sparks 1952). This fact, coupled with the vertebrate evidence, indicates that the climate was probably fairly cold when the bed was deposited. The variations between X and Y and Marr's list probably point only to slight changes from stream conditions to dry land, the fauna at X indicating a stream and that at Y possibly the bank adjacent to a stream.

	X	Y	MARR
Valvata piscinalis (Müller)	—	3	—
Lymnaea truncatula (Müller)	3	—	1
Lymnaea peregra (Müller)	4	3	—
Planorbis leucostoma Millet	1	—	1
Planorbis ? laevis Alder*	4	—	—
Planorbis crista (Linné)	5	—	—
Succinea oblonga Draparnaud	12	—	—
Succinea pfeifferi Rossmässler	3	2	6
Cochlicopa lubrica (Müller)	—	—	2
Pupilla muscorum (Linné)	—	—	common
Vallonia costata (Müller)	—	—	1
Hygromia hispida (Linné)	1	117	common
Helicella ? itala (Linné)*	—	3	—
Agriolimax sp.	—	4	—
Sphaerium corneum (Linné)	355	—	—
Pisidium amnicum (Müller)	—	—	1
Pisidium casertanum (Poli)	—	12	2
Pisidium obtusale (Lamarck)	1	—	—
Pisidium milium Held	25	—	—
Pisidium subtruncatum Malm	157	—	—
Pisidium supinum Schmidt	—	—	1
Pisidium nitidum Jenyns	4	—	—

* A mark of interrogation indicates that the specimens are too fragmentary for positive determination.

In the upper part of the gravel, shells have been obtained in three places: principally in the loam seam at a depth of 5 feet along the face ABCD (Fig. B), but also from the base of the upper stony loam at M and from a loamy patch within the false bedded gravels nearer N (Fig. C).

	ABCD	M	N
Valvata cristata Müller	1	—	—
Lymnaea truncatula (Müller)	3	—	—
Planorbis leucostoma Millet	4	—	2
Succinea oblonga Draparnaud	13	9	—
Pupilla muscorum (Linné)	2,569	16	34
Vallonia tenuilabris (Al. Braun)	2	—	—
Hygromia hispida (Linné)	1	—	—
Helicella ? itala (Linné)	1	—	—
Agriolimax sp.	3	—	—

The astonishing feature of the fauna is the dominance of *P. muscorum*, which forms over 98 per cent of the total number of specimens. The greater number of associated species found in the face ABCD indicates, I believe, only the fact that much more material could be obtained there for washing down, whereas only small amounts were available at M and N. Bag after bag of loam from ABCD was washed down in an endeavour to obtain more specimens of *V. tenuilabris*, and each bag usually contained many *P. muscorum* together with a few other shells. It seems likely, then, that the whole of this upper variable gravel is of the same age and indicative of the same conditions.

From the impoverished nature of the fauna it appears to indicate cold conditions, probably colder than those prevailing during the deposition of the fauna in the lower gravel. In some ways the fauna resembles the *löss* faunas of Europe, containing as it does an abundance of the dry-loving *P. muscorum* associated with damp-loving and pond species. The specimens of *P. muscorum* are a little longer than those found in Holocene deposits on dry chalk hills and appear to approach var. *elongata* Clessin, which is said to be characteristic of damper places.

The shell of greatest interest is *V. tenuilabris*, the occurrence of which has been discussed elsewhere (Sparks 1953), as this is associated in Holland with the third or Riss glaciation (Tesch 1944). Here, at Little Chesterford, it appears in a deposit which appears to have been derived largely as a solifluxion from the boulder clay capping the valley sides in the cold conditions soon after the glaciation; and the glaciation most likely to have been responsible for that boulder clay is the Riss glaciation.

Borings west of the railway, results of which were kindly communicated by Mr. Prime, showed 22 feet of rubbly gravel, so that it appears that the low spur, into the end of which the gravel pit is excavated, is really a subdued fan of waste derived from the higher ground. The same is probably true of the next low spur to the north, as 21 feet of loam and gravel were there proved in the railway cutting (McKenny Hughes 1916).

If the pit is ever reopened great care will be needed in the investigation of the section, as not only was the pit partly backfilled in its earlier phase of being worked, but also, after its period of use in 1951–2, most of it has been filled in with earthy gravel stripped from the surface and with various other forms of rubbish.

(2) GREAT CHESTERFORD (Grid Ref. 504426) AND DEBDEN WATER (Grid Ref. 538341), ESSEX

These two sections, which are respectively 10 and 16 miles S.S.E. of Cambridge, can be treated together as they are of similar type. The banks of the streams in the area usually show 3–4 feet of buff loam overlying angular gravel. The loam contains shells locally at a depth of 1½–3 feet and the following faunas were obtained at Great Chesterford (GC) and in the valley of the Debden Water (DW).

Both these deposits are of Holocene age. They are not so old as such rich deposits as that of Tile Kiln Green, near Takeley, Essex (Warren 1945), which contains a number of species now extinct in the area. Neither do they appear to be very recent, as they lack *Helix aspersa*, *Helicella caperata*, *H. gigaxii* and *H. virgata*, all of which appear to have spread since Roman times (Kennard 1923), while *M. cantiana* and *H. striolata*, both of which are very common modern species, are poorly represented. Although no definite age can be assigned to the deposits, it would appear probable that they are Roman or a little earlier. The presence of both species of *Vitrea*, as in the valley of the Debden Water, appears to be characteristic of many Holocene deposits; both are present in the Tile Kiln Green deposit and also in the Swaffham Prior deposit described below.

Fossil specimens of *Cochlicopa* generally appear to be smaller than modern ones recently described by Quick (1954), the *lubrica* from these deposits varying between 5·0 and 5·9 mm. in length and between 2·35 and 2·55 mm. in breadth, while the single *lubricella* is 4·7 by 1·95 mm.

Similar sizes are found in Holocene shells from Barrington, Cambridgeshire, where both species are present.

	GC	DW
Valvata piscinalis (Müller)	11	—
Bithynia tentaculata (Linné)	6	—
Carychium minimum Müller	1	4
Carychium tridentatum (Risso)	1	22
Lymnaea truncatula (Müller)	2	3
Lymnaea peregra (Müller)	1	2
Planorbis planorbis (Linné)	1	—
Planorbis carinatus Müller	—	1
Planorbis vortex (Linné)	2	—
Planorbis albus Müller	2	—
Succinea putris (Linné)	3	2
Succinea pfeifferi Rossmässler	4	—
Azeca goodalli (Férussac)	—	4
Cochlicopa lubrica (Müller)	65	35
Cochlicopa lubricella (Porro)	—	1
Vertigo pusilla Müller	—	1
Vertigo antivertigo (Draparnaud)	1	—
Vertigo pygmaea (Draparnaud)	1	7
Pupilla muscorum (Linné)	5	16
Acanthinula aculeata (Müller)	—	5
Vallonia costata (Müller)	9	18
Vallonia pulchella (Müller)	47	4
Vallonia excentrica Sterki	61	50
Ena obscura (Müller)	—	3
Cochlodina laminata (Montagu)	—	8
Clausilia bidentata (Ström)	—	2
Cecilioides acicula (Müller)	73	16
Helicigona lapicida (Linné)	—	7
Arianta arbustorum (Linné)	6	1
Helix hortensis Müller	—	2
Helix nemoralis Linné	2	3
Hygromia striolata (C. Pfeiffer)	2	2
Hygromia hispida (Linné)	195	39
Monacha cantiana (Montagu)	2	—
Helicella itala (Linné)	—	7
Punctum pygmaeum (Draparnaud)	—	6
Discus rotundatus (Müller)	4	29
Vitrea crystallina (Müller)	9	5
Vitrea contracta (Westerlund)	—	7
Oxychilus cellarius (Müller)	2	5
Retinella radiatula (Alder)	4	—
Retinella nitidula (Draparnaud)	1	6
Agriolimax sp.	5	—
Pisidium nitidum Jenyns	6	3
Pisidium moitessierianum Paladilhe	3	—

(3) Swaffham Prior, Cambridgeshire (Grid Ref. 558649)

My attention was kindly drawn to this deposit, which occurs on the edge of the Fens, 8 miles N.E. of Cambridge, by Professor J. G. D. Clark. The shells occur in the upper part of a deposit of chalky silt, which is covered by a foot or so of black peaty earth. The deposit was revealed when Professor Clark, after finding flint implements on the surface, had a section excavated in a field opposite Adventurer's Farm.

The Mollusca found in the deposit were the following :—

Pomatias elegans (Müller)	119
Acme fusca (Montagu)	1
Carychium minimum Müller	12
Carychium tridentatum (Risso)	954
Lymnaea peregra (Müller)	1
Planorbis planorbis (Linné)	1
Planorbis leucostoma Millet	5
Planorbis ? laevis Alder	4
Planorbis crista (Linné)	2
Succinea putris (Linné)	12
Succinea pfeifferi Rossmässler	10
Cochlicopa lubrica (Müller)	8
Vertigo pusilla Müller	10
Vertigo pygmaea (Draparnaud)	3
Vertigo moulinsiana (Dupuy)	1
Pupilla muscorum (Linné)	6
Acanthinula aculeata (Müller)	23
Acanthinula lamellata (Jeffreys)	13
Vallonia costata (Müller)	103
Vallonia pulchella (Müller)	2
Ena obscura (Müller)	3
Cochlodina laminata (Montagu)	10
Clausilia bidentata (Ström)	20
Cecilioides acicula (Müller)	18
Helix nemoralis Linné	14
Hygromia hispida (Linné)	7
Helicella ? itala (Linné)	10
Punctum pygmaeum (Draparnaud)	16
Discus rotundatus (Müller)	47
Vitrea crystallina (Müller)	10
Vitrea contracta (Westerlund)	31
Oxychilus cellarius (Müller)	20
Retinella radiatula (Alder)	13
Retinella pura (Alder)	10
Retinella nitidula (Draparnaud)	51
Zonitoides nitidus (Müller)	1
Agriolimax spp. (probably *agrestis* (Linné) and *reticulatus* (Müller))	16
Milax sp.	3

The large number of *C. acicula* in this list and in that for Great Chesterford is probably to be explained by the burrowing habits of the species, because the shells look considerably fresher than the remainder.

In many ways this is an interesting fauna. The presence of *A. lamellata* and both species of *Vitrea* and the absence of the common modern species, which have spread since Roman times, suggests that it is an early Holocene fauna. It is certainly representative of climatic conditions no cooler than those at present.

The greatest peculiarity is the number of dry-loving species, especially *P. elegans*, *P. muscorum* and *H. itala*. Further, *C. tridentatum* is much more common than *C. minimum*, whereas the modern fauna of Wicken Fen shows a great dominance of the latter, which is better adapted to wet conditions. Similarly, *V. costata* greatly exceeds *V. pulchella*, which is the better adapted to damp conditions and the more common at Wicken Fen.

There are two possible explanations for this anomaly. The first, that the few freshwater snails and the marsh species such as *Succinea* and *Zonitoides nitidus* represent the indigenous fauna and that the dry species have been washed in, seems the less likely. It would imply that the dry species had been washed in from Reach, half a mile or more away, in such numbers that *P. elegans*, *V. costata* and *C. tridentatum* constitute the main elements of the fauna. The second explanation is that the snails lived at a time when the surface, composed of the chalky silt, was largely dry and that they have been buried beneath a later peat formation, represented to-day by the foot of peaty earth above them. The original thickness of the peat may have been much greater, as it is a well known fact that the peat has " shrunk " to an alarming extent on the edge of the Fens. This second hypothesis seems to me to be the more likely.

I would like to express my great appreciation of the kindness of Mr. Hugh Watson in being always ready to examine difficult species of snails.

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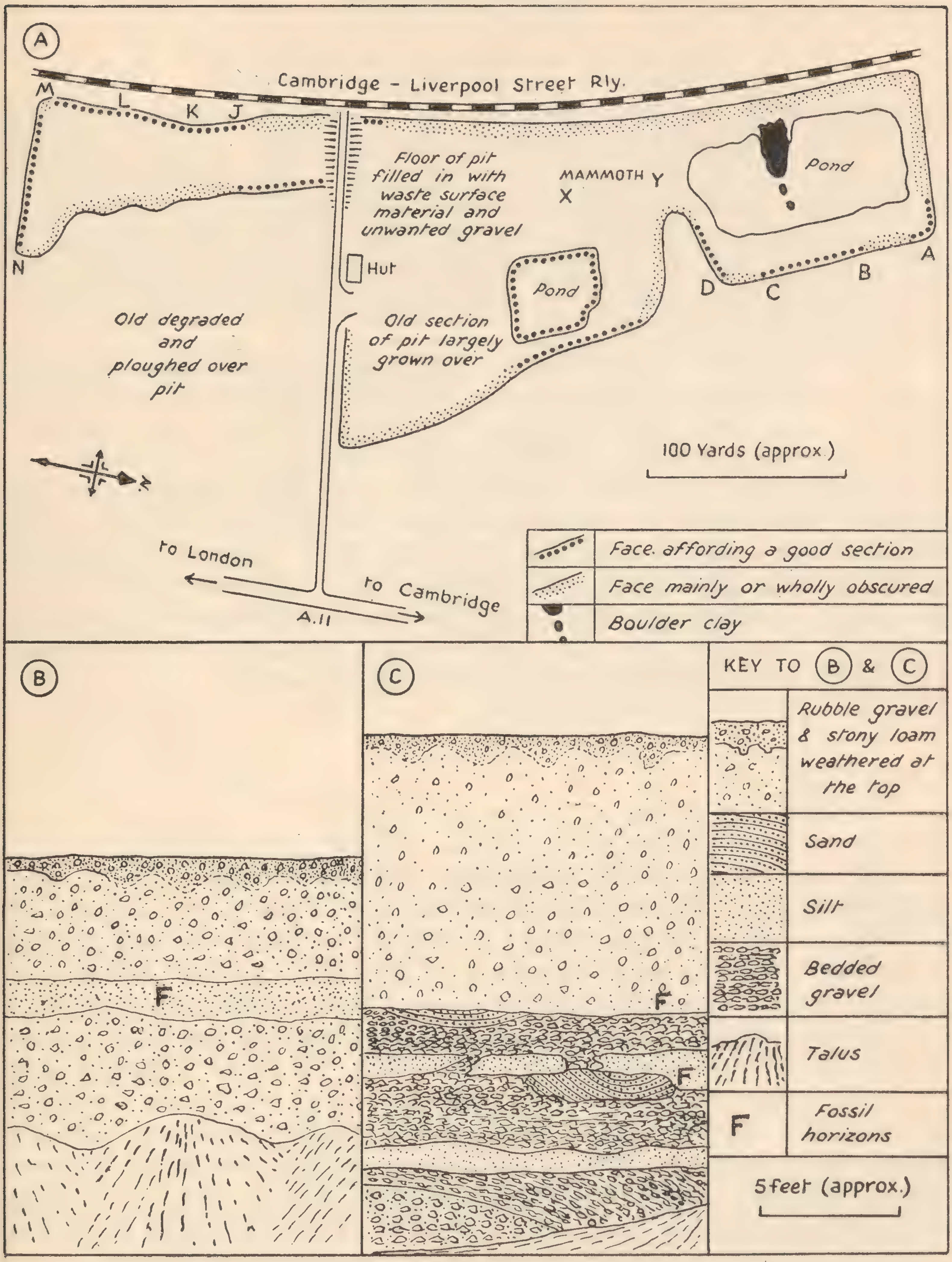
EXPLANATION OF TEXT-FIGURE.

A. Plan of the Bordeaux pit, Little Chesterford, July 1952.
B. Generalized section typical of the face ABCD.
C. Generalized section typical of the face MN.


A
Cambridge - Liverpool Street Rly.
M
L
K
J
N
Floor of pit filled in with waste surface material and unwanted gravel
MAMMOTH Y
X
Pond
A
B
C
D
Hut
Pond
Old section of pit largely grown over
Old degraded and ploughed over pit
N
100 Yards (approx.)
to London
to Cambridge
A.11
Face affording a good section
Face mainly or wholly obscured
Boulder clay
B
F
C
F
F
KEY TO B & C
Rubble gravel & stony loam weathered at the top
Sand
Silt
Bedded gravel
Talus
F
Fossil horizons
5 feet (approx.)

PLANORBIS (*GYRAULUS*) *LAEVIS* ALDER IN SURREY.

By M. P. Kerney.

(*Read before the Society*, 15 *January* 1955.)

Planorbis laevis has been recorded from rejectamenta of the River Thames at Richmond by Cockerell (*Zoologist*, 1885, p. 115), and the following entry in the Society's Census record books presumably refers to the same reputed occurrence: *Planorbis glaber*, Kew, rejectamenta of Thames, 2, broken, T. D. A. Cockerell, Dec. 29, 1884, authenticated by J. W. Taylor, Jan. 30, 1885. Boycott, however, when scrutinizing the records for the 1921 edition of the Census, rejected this record, the only one for Surrey.

In the summer of 1954 I found *P. laevis* living in abundance on weeds in the boating lake at Dulwich Park. This park was formed in 1890 from meadow land previously belonging to Dulwich College, and the lake, which is not a natural one, probably dates from that time. The shells were encrusted with a confervoid growth and at first sight did not seem like typical *P. laevis*, but the determination has been confirmed by Mr. Hugh Watson, Dr. G. Mandahl-Barth and Mr. A. E. Ellis. The following species were also found in the lake at Dulwich Park: *Planorbis crista*, *Physa fontinalis*, *Potamopyrgus jenkinsi*, *Pisidium casertanum*, *P. nitidum*, *Sphaerium lacustre*. One isolated left valve of a dead shell of *P. nitidum* was abnormal in possessing two posterior lateral teeth.

Helix nemoralis **(L.) in a calcium deficient habitat.**—I have often searched in nettle-beds by the railway to find out just where *H. nemoralis* go during hours of daylight. They can usually be found on the underside of the leaves near the top of the plants. The only time I have found them upon the ground, except on dull wet days, has been when the snails have been rasping away at dead shells of snails destroyed the previous year by fire, when the dry mown herbage was burnt. It is not uncommon to find two snails rasping away at the same shell. I once saw three *H. nemoralis* rasping a small shell of the whelk (*Buccinum undatum*), which had presumably been thrown from a carriage window by trippers. Snails while on the ground are in constant danger from the thrush, and many fall victims to this bird, whilst those resting under the leaves about three parts of the way up the nettle plants seem to be safe.

G. W. Pitchford.

(*Read before the Society*, 19 *March* 1955.)

ON THE FORMER OCCURRENCE OF *VERTIGO PARCEDENTATA* (AL. BRAUN) IN HERTFORDSHIRE.

By M. P. Kerney.

(Read before the Society, 19 *March* 1955.)

In 1949 Mr. R. J. Wiggs and Mr. Frank Berry discovered a deposit of calcareous tufa at Norton Common, Letchworth, Hertfordshire, and obtained from it a small series of non-marine Mollusca. These shells, which Mr. Wiggs has kindly placed at my disposal, are remarkable for including examples of *Vertigo parcedentata*, a form not known living in this country. In November 1954 the writer visited Norton Common under the guidance of Mr. Berry, and large fresh collections were made. The fauna thus obtained is of sufficient interest to be here recorded, and the mode of its occurrence described.

Description of the Tufa.

The existence of a tufaceous deposit was first revealed by examination of the material thrown out of a rabbit-warren on Norton Common (Grid Reference 52/216332). The site lies at about 230 feet O.D. in a shallow valley cut in the chalk and floored with boulder clay, which is now occupied by a stream known as the Pix. This stream flows first west, and then north to join the Hiz, a tributary of the River Ivel, at Church End, Henlow, some five miles away. The tufa is on the south side of the Pix and about 10 feet above it. A small pit was subsequently dug and the following section revealed:

1.	Dark peaty soil.	8 inches.
2.	White to yellowish calcareous tufa, containing a small proportion of argillaceous material, often as wisps and streaks. The lower part is fairly soft and readily breaks down in water, but the upper part is cemented by resolution, and contains some "iron-pan".	2 feet.
3.	Chalky boulder clay.	Top only seen.

Strictly speaking, Mollusca are not common in the tufa, and a considerable amount was washed and examined to obtain the thirty-six species listed below.

Notes on Certain Species.

The two most important species present are undoubtedly *Vertigo parcedentata* and *Discus ruderatus*. Both were probably extinct in Britain by Bronze Age times (*circa* 1900 B.C.), but occur, usually in small numbers, in certain Pleistocene and early Holocene deposits. The forms here included under the name *parcedentata* are considered by some authors to comprise two distinct species, *Vertigo genesii* Gredler and *V. concinna* Scott (? = *Pupa parcedentata* Al. Braun, 1847), but as so much uncertainty exists regarding their status, and as no consistently reliable characters can be found to separate them, it has been thought best to follow Sparks in provisionally retaining Braun's name to include both forms. For

List of Mollusca, Norton Common Tufa.

	No. of Specimens.
Pomatias elegans (Müller)	10
Carychium tridentatum (Risso)	68
C. minimum (Müller)	7
Lymnaea truncatula (Müller)	64
L. palustris (Müller)	11
Planorbis leucostoma Millet	56
†*Succinea oblonga* Draparnaud	117
S. pfeifferi Rossmässler	40
Cochlicopa lubrica (Müller)	29
†*Vertigo pusilla* Müller	3
V. antivertigo (Draparnaud)	1
†*V. substriata* (Jeffreys)	3
V. pygmaea (Draparnaud)	5
**V. parcedentata* (Al. Braun)	732
Pupilla muscorum (Linné)	20
Acanthinula aculeata (Müller)	6
Vallonia costata (Müller)	84
V. pulchella (Müller)	70
V. excentrica Sterki	2
Ena obscura (Müller)	1
Clausilia bidentata (Ström)	4
Arianta arbustorum (Linné)	1
Helix nemoralis Linné	3
†*Hygromia liberta* (Westerlund)	35
Punctum pygmaeum (Draparnaud)	1
**Discus ruderatus* (Férussac)	1
D. rotundatus (Müller)	7
Arion sp.	common
Euconulus fulvus (Müller)	14
Vitrea crystallina (Müller)	32
Retinella radiatula (Alder)	12
R. pura (Alder)	2
R. nitidula (Draparnaud)	8
Limax sp.	8
Pisidium casertanum (Poli)	3 valves
P. obtusale (Lamarck) var. *lapponicum* Clessin	3 valves

* = Species not known living in Britain.
† = Species not known living in Hertfordshire.

discussions of this question see Kennard and Musham (1937) and Sparks (1952).

Generally speaking, the Norton Common shells are of the edentulous *concinna* type. They were compared with a similar series from Bed E at Barrington, Cambridgeshire, and although a little more variation is shown by the former, probably due to the larger number of shells available, there seems little doubt that we are dealing with only one species. The same conclusion was reached after examining fossil "*parcedentata*" from Wilstone, Hertfordshire, and from Tilekiln Green, Essex.

Discus ruderatus, although found to-day in high northern latitudes of Europe, is certainly not exclusively a "cold" form, and is common in several Pleistocene terrace deposits in the valleys of the Thames and the Cam, associated with warm interglacial mammalian and molluscan faunas.

Pisidium obtusale var. *lapponicum*, a new record for Hertfordshire, is generally considered to be an arctic variety or subspecies of *obtusale.* It occurs plentifully in the late Pleistocene–early Holocene series of the Lea Valley in Essex, where it is associated with a restricted and stunted molluscan fauna and with arctic plants (Warren, 1952), and the form has also been recorded from the oldest horizon, probably of " Late Glacial " date, in the White Bog, Killough, Co. Down. Yet *lapponicum* still lives in Lough Neagh, and its occurrence at Letchworth may be regarded as a local survival under more genial conditions.

Succinea oblonga (*vera*) constitutes a new record for the Holocene of Hertfordshire, but has been found in the Ponders End stage of the Lea Valley (late Pleistocene), associated with *Vertigo parcedentata.* The species is slowly dying out.

Vertigo pusilla and *V. substriata* are interesting as bearing out the former wide distribution of these species, which are on the wane in Britain to-day, and are not recorded living in Hertfordshire.

Pomatias elegans does not favour excessively damp habitats and is somewhat out of place in the assemblage. The examples are either juveniles or small fragments, and may well have been washed in from higher ground. It is always dangerous to theorize from present distribution, and the species is as much influenced by the presence of abundant calcium carbonate as by temperature, but it is suggestive that *P. elegans* has a distinctly southerly range in Europe and is a native of North Africa. To-day it is losing ground in many counties of England. It is all but extinct in Essex, Cambridgeshire (Brindley, 1904) and Hertfordshire, though empty shells are common on the chalk hills, and it appears that the species reached its acme, both as regards abundance and size, about Beaker times (early Bronze Age). The few known records of living *P. elegans* in the Hitchin area have been given by B. Verdcourt (1945).

Conclusions.

The molluscan fauna described above is predominantly a damp-loving one, such as would live in a marshy environment. Fresh-water shells are restricted to species that require little permanent water, perhaps a few inches at most, standing in a swampy area in which tufa was precipitated from springs breaking out of the hillside above. This swamp was probably covered with rushes upon which flourished *Lymnaea truncatula*, *Succinea oblonga* and *Vertigo* spp., their shells after death becoming incorporated in the tufa and preserved in perfect condition.

The only other deposits in Hertfordshire which have yielded molluscan faunas at all comparable are the beds of tufa and associated peat at Wilstone, near Tring, discovered by Charles Oldham and fully described by Kennard (1943). The Wilstone fauna includes *Vertigo parcedentata*, *V. pusilla*, *V. substriata* and *Discus ruderatus*, but *Succinea oblonga* does not occur there. The assemblage is that of a marsh bordering more open water. *V. parcedentata* also occurs in the Pleistocene of Broxbourne, and *V. substriata* at King's Langley and *V. pusilla* at Hunton Bridge, in deposits of Holocene age. *Vertigo pusilla* was recently found by the writer in an undescribed pre-Bronze Age " rubble-drift " at Chalk Hill, Great Offley.

Similar extensive tufaceous beds are now known from many of the chalk and limestone tracts of Britain and Ireland and often contain rich faunas which could not be matched living in any part of the British Isles to-day. Some may be of Boreal date (*c.* 6800–5000 B.C.), but most appear to belong to the Atlantic phase of the Holocene (*c.* 5000–2500 B.C.), a period of heavy rainfall, when a raised water-table caused lime-charged springs to flow in places now dry, and when high annual temperatures produced rapid evaporation. Little work has yet been carried out on tufas and associated deposits in this country, but in tropical lands their precipitation seems to be mainly due to the last named factor, aided in a manner not perfectly understood by green filamentous algae, certain mosses, and possibly other organisms.

Acknowledgements

My sincere thanks are due to Dr. H. E. Quick and to Mr. A. W. Stelfox for determining examples of *Succinea* and *Pisidium* respectively, and to Mr. R. J. Wiggs and Mr. Frank Berry of Letchworth for their kind help ; without their careful local observations this note could not have been written.

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Mollusca of Hertfordshire.—Volume 24, part 3, of the *Transactions of the Hertfordshire Natural History Society and Field Club*, January 1955, comprises a list of the Mollusca of the county compiled by our President, Mr. L. W. Stratton. Localities are given for Pleistocene, Holocene and Recent occurrences. Copies are obtainable from The Riverside Press, Ltd., Richmond Bridge Works, Cambridge Road, Twickenham, Middlesex, price 7*s.* 6*d.*

ROEBUCK'S PAPERS ON SCOTTISH NON-MARINE MOLLUSCA.

By W. Russell Hunter and Myra Russell Hunter.

(*Read before the Society*, 19 *March* 1955.)

It is not generally known that, in the *Glasgow Naturalist*, vol. 8, No. 4, pp. 131–141 (February 1920), there was published posthumously a paper entitled " Lanarkshire and its Molluscan Fauna " by W. Denison Roebuck, which had been read before the Natural History Society of Glasgow on 28 November 1916. This paper was not included in the Conchological Society's set of Roebuck's papers on the Mollusca of various Scottish counties and, under the circumstances, it is probable that reprints were never distributed. Further, this paper was not noted by Boycott (*J. Conchol.* **16,** 166) in his list of Roebuck's papers on Scottish vice-comital records, which list is copied in the most recent edition of the Census (*J. Conchol.* **23,** 244). There are other omissions and errors in the list. Although five papers are listed which had been published in the *Scottish Naturalist*, each dealing with a separate vice-county, the comparable paper on the non-marine Mollusca of the Outer Hebrides (v-c 110), published in 1918 in the same journal, is omitted. Boycott's reference to Roebuck's initial paper in the *Proceedings of the Royal Physical Society of Edinburgh* is in error in two respects. First, the pagination runs from 437 to 503 ; and second, this paper, though included in the volume of the *Proceedings* issued for 1888–1890, was actually published in 1891. In at least three other papers Roebuck himself quotes this paper as being published in 1891. Other detailed papers on additions to the Census for Scottish vice-counties were published by Roebuck in the *Annals of Scottish Natural History* in the years 1892–5, and at other times and elsewhere. The following list of papers on Scottish vice-comital records of non-marine Mollusca, published in Scottish journals by W. Denison Roebuck, omits very short notes dealing with single records (most of which are repeated in the longer papers). We are indebted to Mr. A. E. Ellis for his help in preparing this note.

1883. Berwickshire Slugs. *Scot. Nat.* **7,** 105–6.
1891. Census of Scottish land and fresh-water Mollusca. *Proc. Roy. Phys. Soc. Edinb.* **10,** 437–503.
1891. Notes on the authenticated comital distribution of Scottish land and fresh-water Mollusca. *Scot. Nat.* **1891,** 127–131.
1892. Additions to the authenticated comital Census of the land and fresh-water Mollusca of Scotland. *Ann. Scot. Nat. Hist.* **1892,** 104–7.

Four more papers bearing this last title subsequently appeared in the same journal :—

1892. *Ann. Scot. Nat. Hist.* **1892,** 235–8.
1893. *Ann. Scot. Nat. Hist.* **1893,** 164–170.
1894. *Ann. Scot. Nat. Hist.* **1894,** 153–8.
1895. *Ann. Scot. Nat. Hist.* **1895,** 149–154.

No further papers appeared for some years under Roebuck's name but W. Evans (a correspondent of both Roebuck and J. W. Taylor) published lists of authenticated records in *Ann. Scot. Nat. Hist.* **1898,** 185–6; **1899,** 117; and J. Waterston a list in *Ann. Scot. Nat. Hist.* **1903,** 52–3.

1904. *Limax tenellus* in Scotland. *Ann. Scot. Nat. Hist.* **1904,** 218–221.

In the years 1905–1915, several small notes including authenticated vice-comital records were published by J. Waterston, J. W. Taylor, R. Godfrey and G. A. Frank Knight in *Ann. Scot. Nat. Hist.*, *Scot. Nat.* and *Trans. Perthshire Soc. Nat. Sci.*

In 1913 F. Booth published a series of papers on non-marine Mollusca in the North of Scotland (*Scot. Nat.* **1913,** 8–13, 56–9, 106–9, 132–6, 201–5, 246–253 and 274–8). These reported collecting done in 1910, and each carried an introduction by Roebuck. A paper dealing with general aspects of these records was published by Roebuck and J. W. Taylor :—

1913. Report on the investigation of land Mollusca in the north of Scotland. *Scot. Nat.* **1913,** 278–282.
1916. Easterness : the vice-county and its molluscan fauna. *Scot. Nat.* **1916,** 107–113.
1916. Main Argyll and its inland molluscan fauna. *Scot. Nat.* **1916,** 229–239.
1916. Wigtownshire and its inland molluscan fauna. *Scot. Nat.* **1916,** 253–6, 271–4 and 295–8.
1916. Easterness Mollusca : Additions. *Scot. Nat.* **1916,** 282.
1917. The Stewartry of Kirkcudbright and its inland molluscan fauna. *Scot. Nat.* **1917,** 7–12, 27–33.
1917. Elgin : the vice-county and its molluscan fauna. *Scot. Nat.* **1917,** 79–89.
1917. Wigtownshire Mollusca. *Scot. Nat.* **1917,** 120.
1917. Molluscan authentications for Dumbartonshire. *Scot. Nat.* **1917,** 230.
1917. Banffshire molluscan additions. *Scot. Nat.* **1917,** 277.
1918. Easterness Mollusca. *Scot. Nat.* **1918,** 47.
1918. *Limnaea glabra*, *Hyalinia lucida* and *Zonitoides nitidus* in Stirlingshire. *Scot. Nat.* **1918,** 70.
1918. *Limnaea glabra* as a Scottish mollusc. *Scot. Nat.* **1918,** 113–19.
1918. Caithness Slugs. *Scot. Nat.* **1918,** 267.
1918. The molluscan fauna of the Outer Hebrides. *Scot. Nat.* **1918,** 275–286.
1920. Lanarkshire and its molluscan Fauna. *Glasg. Nat.* **8,** 131–141.

TRUNCATELLINA CYLINDRICA BRITANNICA (PILSBRY) IN DORSET AND ISLE OF WIGHT.

By A. G. Davis.

(*Read before the Society*, 15 *January* 1955.)

In August and September 1954, I worked over the localities in Dorset and the Isle of Wight where *Truncatellina* had been recorded, my chief objective being to find out if *T. cylindrica britannica* had an earlier history.

Dorset.

Portland.—This area is probably the best known one in the south of England and one where *britannica* has been found in numbers. My friend Mr. Michael Goodchild informed me that the species was found quite easily at Church Hope, about the cliff path leading to the beach, during Easter. I could not get there until the third week in August, and by that time the rocks and path had become very dry. Snails could only be found by delving deeply among the talus of rocks and, finding this kind of search time consuming and unprofitable, I commenced tests of the soil and rock debris. For this purpose I carry a small sieve with a mesh not coarser than 30–35 to one inch. Samples of the soil, etc., are sifted on the spot, and the larger fragments and rubbish are picked out by hand or better, by use of a coarser sieve. A small quantity of the fine material left on the sieve is spread in the tray of a matchbox and searched with a lens. At this locality the first trial with the sieve was successful in locating a spot where *Truncatellina* was present. The next operation was to pull up tufts of grass and herbage from where the sample was taken, shake the roots into a sack and then sweep up all the debris lying in crevices and ledges of rock. I did this about six times, starting at the top of the cliff, and found productive samples almost to beach level. This gathering when sorted yielded over 500 examples of *T. britannica.* Very few were alive, the remainder very dirty and matted with soil and humus, but these were restored in great part by the application of hot water and household detergent.

The Raised Beach and Bill, Portland.—For full account and bibliography see W. J. Arkell, 1947, Geology of Weymouth, *Mem. Geol. Survey*. The deposits resting on the Raised Beach are generally accepted as late Pleistocene. Collections made recently by Mr. J. N. Carreck and myself have not added to the published faunal lists. The most characteristic shell here is *Succinea oblonga*, and as far as I can ascertain previous collections were made on the western side of the tip of the Bill. On examining the Bill on the eastern side, but still in sight of the lighthouse and masts, I found that *S. oblonga* was replaced by *S. pfeifferi*. The commonest shell was *Helicella virgata*, while of more rarer occurrence was *Lymnaea truncatula*. A sample taken at this spot when washed yielded six examples of *T. britannica*.

Holworth, near Ringstead.—At the top of the cliff just below Holworth House are some six feet of hill wash, consisting of a light brown fine textured loam with a terrestrial fauna of over 30 molluscan species. All the species still live in the district or within a few miles, *Helix aspersa* and *Pomatias elegans* being particularly abundant. A test of the soil by sieving did not produce *Truncatellina*, but over 50 *T. britannica* were picked out of the sample taken from the hill wash.

OSMINGTON MILLS, Cliffs down to beach level.—*T. britannica* has been recorded from here, but I failed to find living examples in September. A sample of soil and root shakings taken half way down the cliff produced five dead and bleached shells.

ISLE OF WIGHT.

VENTNOR DISTRICT.—*Truncatellina* has long been known in the vicinity of Ventnor, particularly at Steephill Cove. Although Mr. B. Taylor of the British Museum (Natural History) found a few living examples of *T. britannica* at Steephill about 3 years ago, I was unable to find it in 1954. My tests of soil and hill washes were all negative, but time did not permit me to test all the likely situations.

In the J. W. Taylor collection there is a specimen collected by J. W. Wood in 1869 from Niton.

ST. CATHERINE'S DOWN.—Kennard & Woodward, 1901, *Proc. Geol. Assoc.* **17**, 229. Quite near Steephill are hill washes belonging to a series which Kennard & Woodward have grouped together under the heading St. Catherine's Down. They list 29 terrestrial species and attach much importance to the deposit, for pre-Roman midden remains are seated upon it. Early in 1954 Mr. and Mrs. J. N. Carreck examined these beds and found at Flower Brook Gardens, Ventnor, a stream had cut into them. They kindly sent me samples for examination. Twenty-one of the species recorded by Kennard and Woodward were confirmed, and in addition there were three examples of *T. britannica*.

The result of this investigation shows that this snail has inhabited the southern parts of England from Neolithic times to the present, and there are no signs that it is losing its hold. In the area dealt with I have found no trace of typical *T. cylindrica* (Férussac), for as far as my searches for this species have gone I find it belongs to East Anglia, the Midlands and North.

***Lauria anglica* (Wood) at Meathop Fell, Westmorland.**—Conifers are plentiful on the Grange side of the Fell, and the wind blows the pine-needles into clumps between loose stones. These clumps retain moisture and are ideal for propagating the white feather-like fungus which grows about them. In these clumps of pine-needles *Lauria anglica* is fairly common.

G. W. PITCHFORD.

(*Read before the Society*, 19 *March* 1955.)

THE RANGE OF *PLANORBARIUS CORNEUS* (L.) IN THE BRITISH ISLES.

By N. F. McMillan.

(*Read before the Society,* 18 *December* 1954.)

Planorbarius corneus is a favourite aquarium animal and hence is apt to occur in unexpected habitats where it has been " planted ", either intentionally or otherwise. Boycott (1936) commented upon this and the resultant difficulty of determining the true geographical range of the species in Britain.

P. corneus is a species which, preferring hard water, dies out westward and in Herefordshire is nearing the western limit of its range. The only Herefordshire record is Boycott's own " Hereford, one immature and broken, April 1913 " (Conchological Society Census record). Presumably referring to the same record Boycott (1936, p. 158) states, " The only Herefordshire habitat for *Planorbis corneus* was a running ditch with calcium 85." In July 1954 the species was found abundantly in a good sized pond at Aymestry gravel workings in the north-west corner of the county, N.W. of Leominster. The snails were of average size. The water was not tested for " hardness ", but wells around Leominster yield very hard water and in the River Lugg close by Boycott found calcium 58.

Mr. A. E. Ellis has kindly sent me the following Welsh records of *P. corneus*, all extracted from the Conchological Society Census record-books :—

Canal at Chirk, Denbighshire (C. Oldham 1922). This is the Shropshire Union canal and the water is quite soft (calcium 8—see Boycott & Oldham, 1936).

Shropshire Union Canal at Newtown and Llanbwchaiarn, Montgomeryshire (Oldham and Boycott, 1935).

Llangorse Lake, Brecon (C. Oldham, 1928).

Glamorgan canal, Cardiff (P. W. Richards, 1919).

It is noteworthy that in every case but one the habitat is a canal, notoriously suitable vehicles of colonization, and in Llangorse Lake, the sole exception, Boycott (1936) remarks " *Planorbis corneus* (which appeared in the lake between 1904 and 1928) . . ."

Standen (1887) writing of Lancashire had the impression that *P. corneus* was not truly native there, though now common and thoroughly at home, and Oldham (1908) felt the same of its occurrence in Cheshire. It is known to have been deliberately introduced into the Chester district. In the Wirral peninsula of Cheshire it was similarly introduced into one locality, and is strongly suspect in a number of water-filled marl-pits around Bromborough and Raby, mid-Wirral (McMillan, 1947 ; McMillan and Millott, 1954). A hundred years ago an ardent conchologist, James Wright Whitehead, collected widely in Wirral (see Fisher and Jackson, 1936), yet does not mention the species at all.

In Shropshire the Census record is likewise from a canal—the Shropshire Union—and *P. corneus* was not found in the three Shropshire meres (Colemere, Ellesmere and Whitemere) which I have sampled.

In Ireland the species appears to be native only in a very limited area: Praeger (1950) summarizes it well. He says, "a peculiar distribution—drains and pools in Kildare, Leix and Meath (a restricted area drained by the Liffey and Barrow); River Lagan above Belfast; a stream-mouth on the south-eastern shore of Lough Neagh (a very isolated station); and Markree, in Sligo (where it may have come with water-plants). The last three stations are far to the north of its headquarters." He goes on to say that its range suggests fairly recent arrival in Ireland. Some of the Irish stations (R. Lagan, Belfast; *Cushendun, Co. Antrim; Mountstewart, Co. Down; Rathfarnham and the Royal Canal, both near Dublin) are undoubtedly recent introductions. At Cushendall (Fisher, 1930) and Mountstewart (Welch, 1933) it occurred in small garden ponds; it appears to have escaped into the Lagan from an ornamental water on a neighbouring estate (Welch, 1933; Macdonald, 1935), and Welch always declared that the Markree Castle occurrence of *P. corneus* in a lily-pond was due to introduction with water-plants (Welch, 1901, 1931, 1933).

Praeger's (1938) own find of the species abundantly in a stream-mouth on Lough Neagh is puzzling and certainly does not suggest introduction.

In Scotland, according to the recent Census (*J. Conch.* **23,** Nos. 6 and 7, 1951) *P. corneus* has been introduced into Lanark, Edinburgh, and Main Argyll ("var. *rubra*, near the curling-pond at Bonawe"—*J. Conch.* **19,** 30, 1930); also in Dunbarton (Windy Hill, Milngavie—*J. Conch.* **23,** 418, 1954).

P. corneus is an excellent colonist, though it is difficult to see just how it reaches new loci. It has spread widely in N.W. England, possibly by canal first and later to other waters. Before the Canal Age its range must have been much smaller than it now is.

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* Note, this locality should be Cushendall.

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—— 1931. *Planorbis corneus* in Ulster. *J. Conch.* **19,** 119.
—— 1933. *Planorbis corneus* in the River Lagan. *Irish Nat. Journ.* **4,** 200.

Note.

" Calcium " = milligrammes of calcium per litre, i.e. parts per million (Boycott, 1936).

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND

734th Meeting, held at the British Museum (Natural History), 20 November 1954.

The President in the chair.

Members Elected.

Richard I. Johnson, 124 Chestnut Hill Road, Chestnut Hill, Massachusetts, U.S.A.

Marine Biological Association of the United Kingdom, The Laboratory, Citadel Hill, Plymouth.

Athol J. Wallis, 13 Raincliffe Avenue, Scarborough, Yorkshire.

Peter Tolman Warren, 23 Rockhampton Road, South Croydon, Surrey.

Communication.

" On a collection of *Pomacea* from Colombia," by T. Pain.

Exhibits.

Special exhibits : Tellinidae, *Tropidophora.*

Mr. C. P. Castell : fossil Tellinidae from the British Museum collections.

Mr. T. Pain : *Tropidophora* and *Otopoma* ; paratype of a new subspecies of *Pomacea* from Colombia.

Mr. G. W. Pitchford : *Helix pomatia* from various English localities.

735th Meeting, held at the British Museum (Natural History), 18 December 1954.

Mr. A. G. Davis, Vice-President, in the chair.

Member Elected.

Nederlandse Malacologische Vereniging, Zoölogisch Museum, Plantage Middenlaan 53, Amsterdam, Holland.

Communication.

"The range of *Planorbarius corneus* (L.) in the British Isles," by Mrs. N. F. McMillan.

Exhibits.

Special exhibits: Vermetidae, *Theodoxus*.

Rev. H. E. J. Biggs: *Theodoxus* from England, Denmark, Italy, Palestine and Persia.

Mr. C. P. Castell: Recent and fossil Vermetidae and *Theodoxus*, and vermetiform annelids, from the British Museum collections.

Mr. A. E. Ellis: Recent and Pleistocene *Theodoxus*.

Major R. J. Griffiths: *Achatina fulica* from Malaya, illustrating growth stages from egg to maturity.

Mr. M. P. Kerney: *Theodoxus cantianus* and opercula, Dierden's Pit, Swanscombe, and Ingress Vale, Greenhithe (Pleistocene); an undescribed species of *Theodoxus* from Upper Purbeck bed, Burwash, Sussex.

Mrs. Pain: *Limicolaria* from Lake Victoria, Uganda.

Mr. G. L. Wilkins: Vermetidae from the British Museum collections.

736th Meeting, held at the British Museum (Natural History), 15 January 1955.

The President in the chair.

Members Deceased.

The President announced the deaths of William Hill and John Read le Brockton Tomlin.

Member Elected.

Dennis Curry, M.A., F.G.S., 50 Cuckoo Hill Road, Pinner, Middlesex.

Communications.

"*Acanthinula lamellàta* (Jeffreys) in a Holocene tufa at Totland, Isle of Wight," by A. G. Davis.

"*Truncatellina cylindrica britannica* (Pilsbry) in Dorset and Isle of Wight," by A. G. Davis.

"*Planorbis* (*Gyraulus*) *laevis* Alder in Surrey," by M. P. Kerney.

Exhibits.

Special exhibits: *Pinna*, *Valvata*.

The President: British species of *Valvata*.

Mr. C. P. Castell: fossil Pinnidae and recent and fossil *Valvata* from the British Museum collections.

Mr. A. G. Davis: specimens to illustrate his papers.

Major R. J. Griffiths: marine shells from N.W. Malaya.

Mr. H. F. Jones: Cypraeidae from the Capricorn Islands, Queensland.

Mr. M. P. Kerney: *Planorbis laevis* from Dulwich.

Mr. T. Pain: *Ampullaria* from Madagascar.

Mr. G. L. Wilkins : species of *Pinna* and examples of fabric woven from the byssus from the British Museum collections, including a glove from the Sloane collection.

737th (Annual) Meeting, held at the British Museum (Natural History), 19 February 1955.

The President in the chair.

Election of Member.

Thomas Everett Thompson, B.Sc., Department of Zoology, University College of North Wales, Bangor, Caernarvonshire.

Election of Honorary Members.

Harry Howard Bloomer, F.L.S.
John Wilfrid Jackson, D.Sc., F.G.S., F.S.A.
Frank Fortescue Laidlaw, M.A., M.R.C.S., L.R.C.P.
Hamilton Ernest Quick, M.B., B.S., B.Sc., F.R.C.S.
Albert Edward Salisbury, A.M.I.E.E.
Arthur Wilson Stelfox, M.R.I.A., A.L.S.
Ernest William Swanton, O.B.E., A.L.S.
Hugh Watson, M.A.

Election of Scrutineers.

Mrs. M. Ainsley and Mr. G. W. Pitchford were elected scrutineers.

Election of Auditors.

Miss M. Maitland Howard and Mr. G. L. Wilkins were re-elected Auditors.

Statement of Accounts.

The Hon. Treasurer presented the audited accounts for 1954, which were adopted.

Annual Reports.

The reports of the Council, the Yorkshire and North Staffordshire Branches, and the Recorders were presented and adopted.

Votes of Thanks.

Votes of thanks were approved to the Trustees of the British Museum (Natural History) for permitting the Society to hold meetings in the Museum ; to the authorities of the Leeds Museum for housing the Society's library and collections until their removal last year ; and to the Officers and Council for their work on behalf of the Society.

Presidential Address.

The President delivered an address on " *Clausilia dubia* Draparnaud in the Malham area ", illustrated with photographs.

Election of Officers and Council.

The Officers and Council were re-elected as in 1954 (see vol. 23, p. 389). (The office of Librarian has now lapsed.)

Exhibits.

The President : land shells from Malham, Yorkshire.

Mr. A. G. Davis : drawers from the cabinets of J. W. Taylor and J. E. Cooper ; volumes of the Society's portrait collection and Taylor's Monograph notebooks, now in the British Museum (Natural History).

Mr. A. E. Ellis : fourchette et pinces à escargot.

Mrs. Morehouse : Continental land shells.

Mr. G. W. Pitchford : *Polymita* from Cuba ; *Theba pisana* from Tenby.

Dr. H. E. Quick : dissections and drawings of the genitalia of *Clausilia dubia* and *C. bidentata.*

Mr. G. L. Wilkins : two drawers from the collection of Sir Joseph Banks ; " A Catalogue and historical account of the Banks Shell Collection," *Bulletin of the British Museum* (Natural History), Historical Series, vol. 1, No. 3, 1955.

Report of the Council.

Membership now stands at 182 ordinary members and one honorary member, an increase of one during the year. The Society has lost the following members by death : W. Hill, H. O. N. Shaw, G. H. P. Smith, E. R. Sykes and J. R. le B. Tomlin.

Seven ordinary meetings, an annual and a special general meeting have been held at the British Museum (Natural History), by kind permission of the Trustees. Five field meetings were also held (see vol. 24, p. 25).

Two numbers of the *Journal of Conchology* were issued, namely vol. 23, No. 12, 6 May 1954, and vol. 24, No. 1, 20 December 1954.

The decision taken at the special general meeting held on 20 February 1954 (see vol. 23, p. 415) was carried into effect. The library was sold to Messrs. Wheldon and Wesley, Ltd., a set of the *Journal of Conchology*, J. W. Taylor's annotated copy of his *Monograph*, and all manuscripts and notebooks being retained by the Society. Priority was given to members of the Society to purchase items before the issue of a printed catalogue, and the books were available for inspection for a week. The Society's collections have been transferred on permanent loan to the British Museum (Natural History), where a special room has been allotted to them. The British voucher collection, pertaining to the distribution census, is being kept as a separate entity. The Hon. Curator has made a start with cleaning and arranging the collections and has had offers of help from several members.

The late Mr. J. R. le B. Tomlin attained his 90th birthday on 15 August 1954, when he received an illuminated message of felicitation from the Society.

Report of the Yorkshire Branch.

In the unavoidable absence of the lecturer booked for the January meeting, the Secretary read a paper by F. Taylor, published in 1917, on *Menetus dilatatus*. A discussion followed on the distribution of this species on the Yorkshire–Lancashire border. On 13 February Mr. John Armitage referred to his early association with Taylor, and then gave an account of shell collecting in many lands, illustrated by exhibits, including specimens from the hot springs of Iceland. At the March meeting Mr. E. Dearing gave an illustrated talk on the distribution of Mollusca in the Elland Park Wood district, in relation to the geology, topography and flora of the area. Excursions were made to Grass Wood, Grassington, in May, to Byram Park in September, and seven members attended the June meetings of the Yorkshire Naturalists' Union at Crummockdale and Chapel-le-dale.

At the Annual Meeting the membership was stated to be 21 ordinary and 6 life members. The deaths were announced of Miss I. Dufty and E. A. Wallis. Mr. S. G. Appleyard was elected President for 1955 and Mr. E. Dearing, B.Sc. (37 Ormerod Road, Burnley), secretary. The year concluded with the presentation on 20 November of a number of members' papers on the classification of Mollusca.

S. G. APPLEYARD.

Recorder's Report: Non-marine Mollusca.

Since the last Report (vol. 23, p. 417) the following records have been authenticated. Those marked with an asterisk are from collections in Liverpool Public Museums, communicated by Mrs. N. F. McMillan.

Channel Isles (0): *Phytia myosotis*, Guernsey, R. D. Darbishire*; var. *denticulata*, Guernsey, J. R. le B. Tomlin*.

Devon South (3): *Theodoxus fluviatilis*, " S. Devon," R. D. Darbishire* (in the absence of exact locality this record requires confirmation).

Wilts South (8): *Vertigo substriata*, Donhead St. Mary, H. E. Quick.

Isle of Wight (10): *Acanthinula lamellata*, Holocene, Totland, A. G. Davis.

Kent West (16): *Abida secale*, *Vertigo alpestris*, *Helicella striata*, *H. geyeri*, all Holocene (see vol. 24, p. 3).

Surrey (17): *Planorbis laevis*, Dulwich, M. P. Kerney.

Herts (20): *Succinea oblonga*, Holocene, M. P. Kerney.

Berks (22): *Hygromia liberta*, Pangbourne, H. E. Quick.

Bedford (30): *Pomatias elegans*, Barton, B. Verdcourt.

Warwick (38): *Arion lusitanicus*, Nuneaton, A. J. Cain and M. Williamson.

Merioneth (48): *Acanthinula lamellata*, " Merionethshire," G. W. Chaster*.

Flint (51): *Acroloxus lacustris*, Wepre Woods, J. W. Jackson coll.*

Leicester (55): *Vertigo pygmaea*, Bradgate Park*.

Derby (57): *Lauria anglica*, Charlesworth, J. W. Jackson coll.*

Chester (58): *Vallonia costata*, Leasowe, R. Standen*.

Lancaster South (59): *Theodoxus fluviatilis*, Accrington, T. Peace, 1867*; *Pomatias elegans*, canal bank between Nelson and Brierfield, one immature dead shell, Robert Cairns* (requires confirmation).

Westmorland (69): *Phytia myosotis*, Barrow-in-Furness, J. Roy Hardy, 1891*.

Cumberland (70): *Acme fusca*, Bassenthwaite, W. J. Farrer, 1894*; *Lymnaea stagnalis*, Blackwell, Carlisle, E. Blezard.

Dumfries (72): *Bithynia tentaculata*, *Lymnaea stagnalis*, *Planorbarius corneus*, R. Nith, Dumfries, W. Fingland*.

Fife (85): *Lymnaea stagnalis*, Kirkcaldy (pond), T. Warwick.

Forfar (90): *Hydrobia ulvae*, Montrose, J. W. Jackson coll.*

Elgin (95): *Bithynia tentaculata*, Brodie near Forres (pond), R. Richter.

Westerness (97): *Hygromia striolata*, Arisaig, T. Warwick, *per* H. Schlesch.

Main Argyll (98): *Phytia myosotis*, Oban, T. Edwards*.

King's Co. (131): *Vertigo alpestris*, Holocene (see vol. 24, p. 28).

Collectors who discover any species new to a particular county or vice-county are requested to present specimens to the Society's voucher collection, so that they may be available for checking determinations at any future time.

A. E. E.

Recorders' Report: Marine Mollusca.

There is little to report in the way of records during 1954. Mr. R. Rendall has continued his researches in Orkney, both dredging and shore-collecting, but his numerous records are held over pending the publication of his work. Mr. L. W. Stratton has sent in a list of 56 species he collected on the Hampshire coast and the Isle of Wight; there were not many previous records from Hants.

Attention should be drawn to the occurrence of the American Slipper Limpet, *Crepidula fornicata* (L.) living in Milford Haven, South Wales (see Cole and Baird, *Nature* **172**, 687, 1953) and the probability of its further dispersal elsewhere.

N. F. McMillan.

CHANGES OF ADDRESS

Salmon, M. A., 33 Hyde Park Gate, Kensington, London, S.W. 7.

Short, Capt. F. W., 66a Moana Avenue, Onehunga, Auckland, S.E. 5, New Zealand.

ACCOUNTS FOR THE YEAR ENDING 31 DECEMBER 1954.

Income and Expenditure Account.

Dr.

	£	s.	d.	£	s.	d.
To Annual Subscriptions—						
,, Paid in 1953	7	2	0			
,, For 1954	103	2	2			
,, Arrears	33	8	2	143	12	4
,, Sales				79	0	11
,, Transfer from Life Membership Fund				20	4	0
,, Sale of Library				800	0	0
,, Donation				1	3	0
				£1044	0	3

Cr.

	£	s.	d.	£	s.	d.
By Publication and Distribution—						
Vol. 23, part 11, author's reprints	28	7	10	28	7	10
Vol. 23, part 12	89	0	10			
Author's reprints	9	4	6	98	5	4
				126	13	2
,, Printing and Stationery				3	11	9
,, Zoological Society				2	0	0
,, Zoological Record					8	0
,, Dispatching Parts					11	0
,, Officers' Expenses				9	12	6
,, Bank Charges					4	9
,, Adjustment Charges for Secretary's set of *Journal*				20	0	0
,, Purchase of Capital Stock				800	0	0
,, Balance being excess of Income over Expenditure				80	19	1
				£1044	0	3

Life Membership Fund.

	£	s.	d.
To Amount of Fund, 1 January 1954	529	14	0
,, Composition Fee	20	0	0
,, Dividends and Interest	20	4	0
	£569	18	0

	£	s.	d.
By transfer to Income and Expenditure Account	20	4	0
,, Amount of Fund, 31 December 1954.	549	14	0
	£569	18	0

Research and Reserve Fund.

	£	s.	d.		£	s.	d.
To Amount of Fund, 1 January 1954	377	18	10	By Amount of Fund, 31 December 1954	391	4	8
,, Dividends and Interest	13	5	10				
	£391	4	8		£391	4	8

BALANCE SHEET.

Liabilities.	£	s.	d.	£	s.	d.
Annual Subscriptions in advance				1	1	0
Life Membership Fund				549	14	0
Research and Reserve Fund				391	4	8
Capital Stock				800	0	0
Balance from Income and Expenditure Account—						
As on 1 January 1954	238	14	6			
For 1954	80	19	1	319	13	7
				£2,061	13	3

Assets.	£	s.	d.	£	s.	d.
4% Funding Loan (cost)	350	0	0			
2½% Defence Bonds (cost)	200	0	0			
3½% War Loan (cost)	40	0	0			
3½% Defence Bonds	800	0	0	1,390	0	0
Cash at Bankers—						
National Provincial Bank	206	13	4			
Post Office Savings Bank	459	19	11			
Cash in hand	5	0	0	671	13	3
				£2,061	13	3

NOTE.—Assets in addition to those set out in the above Balance Sheet are stocks of unsold Publications and Subscriptions in arrears.

Examined and found correct.
M. MAITLAND HOWARD, } Auditors.
G. L. WILKINS,
February 1955.

ALBERT E. SALISBURY,
Hon. Treasurer.
24 January 1955.

CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND

Subscription : £1 per annum. **Entrance fee,** 10s.

Meetings are held at the British Museum (Natural History), by permission of the Trustees, at 2.30 p.m., usually on the third Saturday of each month from October to May. Field Meetings are also held.

The Journal of Conchology is issued free to Members. Back numbers are obtainable from the Hon. Secretary, Mr. C. P. Castell, Department of Geology, British Museum (Natural History), Cromwell Road, London, S.W. 7, and from Mr. David Nutt, 212 Shaftesbury Avenue, W.C. 2.

Special Numbers : *Roebuck Memorial Number*, 1921 (Census of British land and freshwater Mollusca), 5*s*. *Boycott Memorial Number*, 1951 (Census of the distribution of British non-marine Mollusca), £1. *The British Marine Mollusca*, by R. Winckworth, 1932, 3*s*. 3*d*. All post free. Members receive a discount of 25 per cent.

Further information and nomination forms may be obtained from the Hon. Secretary.

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Vol. 2, Part 2.—The families, Limacidae, Endodontidae, Arionidae, Philomycidae, Succineidae, Strobilopsidae Pupillidae, Valloniidae, Cionellidae, Carychiidae, Veronicellidae, Truncatellidae, Pomatiidae and Helicinidae. 640 pages, 304 illus. 1948. Price $8.00. Volume 2 complete, $14.00. Entire set, $25.00.

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Vol. 24] 20 FEBRUARY 1956 [No. 3

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JOURNAL
— OF —
CONCHOLOGY

FOUNDED 1874.

BEING THE ORGAN OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

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Surrey.

Hon. Secretary:
C. P. CASTELL, B.Sc.,
British Museum
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London, S.W.7.

Hon. Treasurer:
A. E. SALISBURY,
A.M.I.E.E.,
51 Amersham Hill,
High Wycombe, Bucks.

CONTENTS.

PAGE
On a collection of *Pomacea* from Colombia, with description of a new subspecies—T. Pain 73
Notes on the generic names *Pomacea* and *Ampullarius*—T. Pain 79
Mollusca on Scottish mountains—W. and M. Russell Hunter 80
The Hill Collection 80
Marine aliens in Cornwall—N. F. McMillan 80
A tidal flat on the Vermilion Sea—S. Stillman Berry . . 81
Cypraea in north-west Malaya—R. J. Griffiths . . . 85
A new Sussex locality for *Pisidium pseudosphaerium* Favre—S. P. Dance 91
Two forms of *Lymnaea auricularia* (L.) in one pond—N. F. McMillan 93
A new species of *Corilla* from Ceylon—G. A. S. Barnacle 95
Agriolimax reticulatus (Müller) feeding on carrion—G. W. Pitchford 96
Mollusca in the alluvia of the River Siagne—A. Comfort . 97
Anodonta minima Millet in the Corfe River, Dorset—A. G. Davis 99
Hygromia subvirescens (Bellamy) in Cornish Holocene deposits—A. G. Davis 100
Hygromia subvirescens (Bellamy) in South Devon—A. G. Davis 101
Lymnaea stagnalis (L.) in Anglesey—N. F. McMillan . . 101
Ena montana (Drap.) in Hertfordshire—L. Lloyd-Evans . 102
Raised beach section at Groomsport, Co. Down—R. MacDonald and J. G. MacWilliams 103
Acroloxus lacustris (L.) in Merionethshire—L. Lloyd-Evans . 104
Review: Mozley, *Sites of Infection*—H. E. Quick . . . 104
Proceedings: 19 March, 16 April, 21 May, 15 Oct., 19 Nov., 1955 105
Change of Address 108
Plates 3 and 4

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Prepaid Annual Subscription 15/6 Single Numbers to Non-Subscribers, 6/6.

SUBSCRIPTIONS became due on 1 January and Members who have not already done so are asked to remit to the Hon. Treasurer without further delay. Those who are in arrears by more than a year cannot expect to receive copies of the *Journal* until their subscription is paid. Members are reminded that the annual subscription is now £1. The mounting cost of printing makes it essential that subscriptions should be promptly paid if the *Journal* is to be published at regular intervals. At present it is financially prohibitive to produce more than two numbers a year. Donations towards the cost of publication would, of course, be gratefully welcomed by the Hon. Treasurer.

Members are requested to notify the Hon. Secretary of changes of address.

Papers intended for publication in the *Journal of Conchology* must be sent to the Hon. Secretary of the Society, *not* the Editor.

THE

JOURNAL OF CONCHOLOGY

VOL. 24 20th February 1956. No. 3

ON A COLLECTION OF *POMACEA* FROM COLOMBIA, WITH DESCRIPTION OF A NEW SUBSPECIES.

By T. PAIN.

(*Read before the Society*, 20 *November* 1954.)

IN spite of the fact that nearly every collection of *Pomacea* contains specimens said to be from the South American Republic of Colombia, they are usually without detailed localities and it is seldom that a well localized series becomes available for study. The writer is therefore deeply indebted to Mr. R. Wright Barker, who generously placed in his hands for identification and report shells of this genus collected by Mr. J. Brouwer, whilst resident in Bogota, and to Mrs. V. M. Hemming for the beautiful figures of the type of the new subspecies described herein.

Family AMPULLARIIDAE.

Genus **Pomacea** Perry, March 1810.

(= *Ampullarius* de Montfort, after March 1810).

Arcana Signature G.5, pl. 12. Monotypic for *P. maculata* Perry.
(= *Ampullaria gigas* Spix, 1827).

Pomacea urceus urceus (Müller).

Nerita urceus Müller, 1774. *Verm. Hist.* **2**, 174.

Ampullaria urceus Alderson, 1925. *Studies in Ampullaria*, 10, pl. 3, figs. 1, 2, 3.

Pomacea urceus Pain, 1950. *Proc. Malac. Soc. Lond.* **28**, 65, pl. 6, fig. 2.

The nominate race of *P. urceus* was not amongst the shells collected by Mr. Brouwer, but has been taken near Puerto Berrio, Rio Magdalena, by Mr. Wright Barker. This thick shelled form, without bands and having a thick fibrous periostracum, has a very wide distribution in northern South America, being reported also from Venezuela (Wright Barker), British Guiana and Trinidad (Pain). The periostracum varies in colour from straw-yellow to almost black; the interior is usually white, sometimes red or salmon pink. It is an inhabitant of streams and rivers in the forested areas, many of which completely dry up during the dry season, the snail remaining buried in the earth, often to a depth of 6 inches or more.

P. urceus urceus is amongst the largest of all *Pomacea.* A specimen from Trinidad obtained by the writer in 1938 measured : length 126, greatest width 115 mm. The Colombian shells are smaller and about average for the sub-species, a typical specimen being : length 93, greatest width 80 mm. In these the periostracum is dark olive-brown, the columella and lip white.

Pomacea urceus guyanensis (Lamarck).

Ampullaria guyanensis Lamarck, 1819. *Hist. nat. Anim. s. Vert.*, **6,** 176.
Ampullaria erythrostoma Reeve, 1856. *Conch. Icon.*, **10,** Mon. Ampullaria, fig. 59, p. 532.
Ampullaria nobilis Reeve, *ibid.*, fig. 8.
Ampullaria guyanensis Alderson, 1925. *Studies in Ampullaria*, 12, pl. 3, figs. 4, 6, pl. 4, figs. 1–5.
Pomacea guyanensis Pain, 1950. *Proc. Malac. Soc. Lond.*, **28,** 67, pl. 7, fig. 3.

This often brilliantly coloured race inhabits savanna swamps and muddy pools. I have never seen it in or even near a locality at which the nominate race occurs. Unlike the latter it is extremely variable, but does not attain the great size reached by *P. urceus urceus* and is usually thinner.

It varies in colour from shells with a dark reddish-brown periostracum and often blood-red columella and interior, to pale olive-green with brown bands. In these the interior of the aperture is usually bluish white with pale green or brown bands. The outer lip and columella vary from brick-red to yellow or ivory-white.

Specimens of the synonymous *P. nobilis* (Reeve, 1856) are the largest examples I have ever met with, one from the Amazon river at Taffe, Brazil being : length 116, greatest width 110 mm.

Mr. Brouwer's specimen is from Cabaceras, Rio San Juan de Dios y Silencio, Carare region (village and river), south of Barranca Bermeza, Magdalena Valley. It is the first record for Colombia. This shell measures: length 92, greatest width 73 mm., and closely resembles one figured by Alderson (1925, pl. 3, fig. 5), both in respect of size and colour. This race is recorded from Venezuela (Wright Barker), British Guiana (Pain), French Guiana (Drouet), Brazil (Richardson ; Pain) and Peru (Yates ; Pain).

Pomacea chemnitzi (Philippi).

Ampullaria chemnitzi Philippi, 1887, Martini and Chemnitz, *Conch. Cab.*, edit. 2, Mon. Ampullaria, 39, pl. 10, fig. 9.
Ampullaria porphrostoma Reeve, 1856. *Conch. Icon.* **10,** Mon. Ampullaria, fig. 30.
Ampullaria porphrostoma Alderson, 1925. *Studies in Ampullaria*, 41, pl. 10, fig. 1.
Ampullaria scholveini Kobelt, 1914. Martini and Chemnitz, *Conch. Cab.* n.f., Mon. Ampullaria, 223, pl. 77, figs. 6, 7.
Ampullaria columbiensis Vanatta, 1915. *Nautilus*, **29,** 83 (*non* Philippi, 1851).

This abundant Colombian species was obtained at a number of localities, La Cueva, Santa Marta, depto. Magdalena, between Tolu and Coveñas, near highway, north coastal area, depto. Bolivar, Laguna de Momil, east of Lorica, north depto. Bolivar.

It is also recorded from Venezuela (H. B. Baker) and Ecuador (Alderson).

As pointed out by Alderson (1925, 41) this species is remarkably constant for a *Pomacea* in its colour and markings and very uniform in size. It usually appears as a light ovate shell, with a thin periostracum of a pale yellow or green, the slender banding faint but distinct. The lip and columella is usually bright orange-red. A typical Colombian specimen measuring : length 64, greatest width 50 mm.

Pomacea semitecta (Mousson).

Ampullaria semitecta Mousson, 1873. *Malak. Blätt.* **22**, 18.

A little known species of which unfortunately there appears to be no really reliable figure. The shell is of moderate thickness, narrowly umbilicate with a strongly curved columella. Periostracum yellowish brown, with numerous indistinct green bands which become very conspicuous at each rest period. Columella and outer lip white. Interior of the aperture bluish-white.

P. semitecta is by no means common and was only obtained at Anca de Caballo, Rio Ermitaño, Magdalena Valley, border between deptos. Santander and Boyaca (tributary of the Magdalena River).

It has been taken also in Venezuela (Wright Barker). Dimensions of a typical specimen : length 33, greatest width 30 mm.

Pomacea cumingi urabaensis n. subspecies.

Shell very globose, solid, umbilicus wide and deep. The surface strongly malleated. Whorls remaining 4, the last very inflated, suture deep, spire obtuse, much eroded. Aperture large, somewhat auriform, the lip effused and flatly expanded. Colour dark olive-green without external bands. Columella and outer lip yellowish brown, interior of aperture bluish white. Operculum, thin, horny.

Measurements (*in millimetres*).

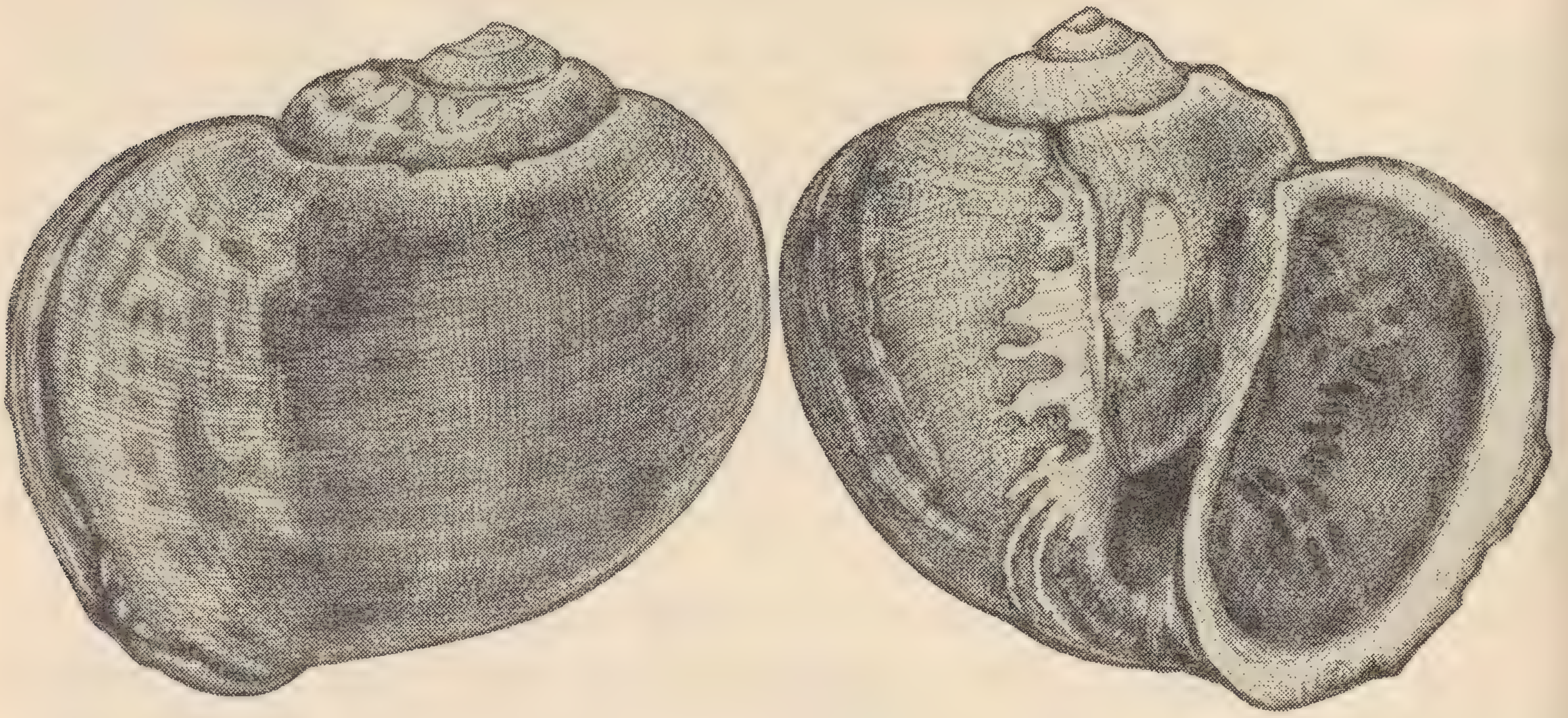
			Aperture.		
	Length.	*Width.*	*Length.*	*Width.*	
(1) .	50	53·5	39	26	Holotype
(2) .	39	40·5	30	20·5	Paratype
(3) .	42	40	31·5	22	,,
(4) .	38·5	27	22	16·5	,,

Type locality.—Golfo de Uraba, northern Antioquia, Colombia (Brouwer). Recorded also from Rio Atrato, depto. Choco (Brouwer). Holotype in the collection of the author.

The discovery of this race of a characteristic Panamanian species in Colombia is of considerable interest, since it is the first record of *P. cumingi* in South America. Its nearest relative is certainly *P. cumingi sanjosensis* Morrison (1946, 6) from San José Island, Pearl Islands, Bay of Panama, from which it differs in being even more ponderous, heavily malleated and without external bands in adult shells.

Morrison discussing his subspecies noticed its superficial resemblance to *P.* (*Effusa*) *glauca* (L.) from northern South America (Atlantic drainage), and suggested that its nearest relative would probably be found in the region of Rio Tuyra, near the Colombian border with Panama. Like *P. cumingi sanjosensis*, *P. cumingi urabaensis* is much larger than any typical *cumingi*, has a much thicker and heavier shell and a wide, deep umbilicus.

P. cumingi urabaensis is the only race of the insular *P. cumingi* so far known from the South American mainland. It does not in any way resemble *P. zeteki* Morrison (1946, 8), the *cumingi* of most authors, from the Isthmus of Panama, and would appear to be a separate ecological race of true *cumingi*, which has been long established on the mainland.



Pomacea cumingi urabaensis. Holotype (natural size).

Subgenus **Effusa** Jousséaume, 1889.

Mém. Soc. Zool. France, **2**, 255. Type *E. luteostoma* Jouss., = *Helix glauca* L.

Pomacea (*Effusa*) *planorbula* (Philippi).

Ampullaria planorbula Philippi, 1851, Mon. Ampullaria, Martini and Chemnitz, *Conch. Cab.* 26, pl. 7, fig. 3.

Pomacea (*Effusa*) *oligista* Pilsbry and Olsson, 1953. *Nautilus*, **66**, 98, pl. 6, fig. 6.

This, the only species of *Effusa* taken by Mr. Brouwer, is from Laguana Luruaco, depto. Altantico, on the road from Cartegena to Barranquilla. This freshwater lake is also the type locality for the synonymous *P.* (*E.*) *oligista* Pilsbry and Olsson. The shell is thin, openly umbilicate, subplanorbid, olive buff, sometimes with dark brown or black spiral bands.

The spire very short, conic, suture very deep. Aperture oval, oblique. A typical example measures : length 14, greatest width 19·5 mm.

It is curious that when the authors of *P.* (*E.*) *oligista* described this supposedly new species they did not compare it with Philippi's *planorbula*, since no mention of the latter is made by them. I am quite unable to separate topotypes of *oligista* collected by Mr. Brouwer from typical *planorbula* and consider them identical.

Subgenus **Limnopomus** Dall, 1904.

J. Conch. **11,** 53–54. Type *Ampullaria columellaris* Gould.

Pomacea (*Limnopomus*) *palmeri* (Marshall).

Ampullaria palmeri Marshall, 1930. *Proc. U.S. Nat. Mus.* **77** (L), 4, pl. 1, figs. 5, 8.

A typical *Limnopomus*, the shell thick, umbilicus narrow, aperture elongate, auriform, outer lip thickened within, columella nearly erect. Colour mixed tints of olive and chestnut, obscurely banded with chestnut, these becoming very prominent at the rest periods. Type locality, a small stream in dense jungle 13 kilometres south of Puerto Santos, Province of Santander del Nort (Palmer), and since taken on the Quebrada Gomes railway, Puerto Wilches, depto. Santander (Brouwer). An adult shell measures : length 53, greatest width 45 mm.

P. (*L.*) *palmeri* is unlikely to be confused with any other Colombian species, except perhaps *P.* (*L.*) *hollingsworthi* (Pain, 1946), but this is a much thicker and heavier shell, with a fibrous yellow periostracum.

Pomacea (*Limnopomus*) *superba* (Marshall).

Ampullaria superba Marshall, 1926. *Proc. U.S. Nat. Mus.* **69** (12), p. 3, pl. 1, fig. 9.

The shell of this attractive species is imperforate, turbinate and rather thick, with a large well rounded body whorl. The aperture is large, the outer lip flaring. Parietal wall with a thick white callus. General colour ashy and brownish, with many revolving chestnut coloured bands, which show prominently on the inner portion of the lip. The type is from Cienaga Totuma, depto. Altantico. Mr. Brouwer obtained it from a number of localities as follows :— Los Volcanes, Sinu, N.W. depto. Bolivar ; Laguna de Momil, E. of Lorica, N. depto. Bolivar ; road between Sincerin and San Cayetano, extreme north of depto. Bolivar ; Arroyo Mancomojān ; headwaters between El Carmen and Ovejas, depto. Bolivar ; near Luruaco (Laguna Luruaco) and at Puerto Caimen, both in depto. Altantico.

The holotype measured : length 53, greatest width 43 mm. Mr. Brouwer's shells are however all smaller, his largest from Puerto Caimen being : length 41, greatest width 30 mm.

In his description of this and preceding species Marshall draws attention to the microscopical sculpture of fine granulose striae ; it should be borne in mind however that this is a feature of all species of *Limnopomus*, when the shell is sufficiently preserved to retain it.

P. (*L.*) *superba* comes close to *P.* (*L.*) *pealeana* (Lea), than which it is larger, much more elongated, has a higher spire and is of darker colour. It may prove necessary to unite them eventually, but the scanty and poorly preserved examples of typical *pealeana* available to me do not allow of adequate comparison. They have not so far been found in the same localities.

Pomacea (*Limnopomus*) *pealeana* (Lea).

Ampullaria pealeana Lea, 1838. *Trans. Amer. Phil. Soc.* (new series), 6.
Ampullaria pealeana Philippi, 1851. Mon. Ampullaria, Martini and Chemnitz, *Conch. Cab.* 62, pl. 27, fig. 7.

A small, globose, imperforate shell, the body whorl very large, spire short, apex acute, pale olivaceous brown, encircled with numerous brown bands. Aperture large, ovate, lip simple, not reflected. Three examples were obtained by Mr. Brouwer in the Turbo region, Golfo de Urabā, N. Antioquia, Colombia, all unfortunately in a poor state of preservation. They are however typical of this species. The type was from Turbaco, Colombia. It is also recorded from Ecuador. Dimensions of a typical Uraba shell: length 26, greatest width 20 mm.

Pomacea (*Limnopomus*) *aurostoma* (Reeve).

Ampullaria aurostoma Reeve, 1856. *Conch. Icon.*, **10**, Mon. Ampullaria, fig. 131.
Ampullaria cerasum Alderson, 1925. *Studies in Ampullaria*, 52, pl. 11, fig. 5.
Pomacea (*Limnopomus*) *aurostoma* Baker, 1930. *Occ. Papers. Univ. Michigan*, **210** (4), 8.

A globose, turbinated shell, narrowly umbilicated, of a dark blackish chestnut, with or without external bands, often with a bright orange-red lip and columella. Taken in Colombia near Luruaco (Laguna Luruaco), depto. Altantico, in company with the quite different *P.* (*L.*) *superba* (Marshall); recorded also from Cucutā (Baker) and from Venezuela.

I am in complete agreement with H. B. Baker (1930, 8) that this species is not, as suggested by Alderson (1925, 52), a colour form of *cerasum* Hanley from Mexico, but an example of convergence under similar habitat conditions. The range of both appears to be discontinuous, since neither is known from Central America south of Mexico.

Subgenus **Marissa** Gray, 1824.

Phil. Mag. and Journ., **63**, p. 276. *Proc. Zool. Soc.*, 1847, p. 148. Type *Helix cornuarietis* L.

Pomacea (*Marissa*) *cornuarietis* (L.).

Helix cornuarietis L., 1758. *Syst. Nat.*, ed. **10**, 771.
Pomacea (*Marissa*) *cornuarietis* Pain, 1950. *Proc. Malac. Soc. London*, **28**, 73 (Synonymy), pl. 8, fig. 14.

Numerous typical examples occurred at a number of localities in northern Colombia, between Tolū and Cuvenās, near highway, north coastal area, depto. Bolivar; Los Volcanes, Sinu, N.W. depto. Bolivar; Laguna de Momil, E. of Lorica; coastal region near Lorica, N.W. depto. Bolivar.

All are of a pale olive-green colour with encircling brown bands. This species is also recorded from Venezuela, Trinidad, British Guiana and Surinam.

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NOTES ON THE GENERIC NAMES *POMACEA* AND *AMPULLARIUS*.

By T. PAIN.

(*Read before the Society*, 21 *May* 1955.)

CONSIDERABLE differences of opinion seem to exist amongst authors and others who have had occasion to refer to the American *Ampullariidae* as to the correct generic name to apply to them, some using *Pomacea* Perry and others *Ampullarius* Montfort. Both generic names were published in 1810, but the former has priority.

The name *Pomacea* Perry dates from March 1810 and is monotypic for *Pomacea maculata* Perry, 1810, which Pilsbry (1927) recognised as being the species described by Spix (1827) as *Ampullaria gigas*. *Pomacea* therefore antedates *Ampullarius* Montfort (after March 1810) and covers the American *Ampullariidae*. Pilsbry's statements on *Pomacea* (1927, 170) were written before his article in the *Nautilus* and must be disregarded.

Dr. Pilsbry (*in litt*, 1953) informs me that in any case he does not accept *Ampullarius*, because he regards all Montfort's names (based on genera of earlier authors) as emendations, not intended as new names.

In his article in the *Nautilus* (*loc. cit.*) Pilsbry also points out that *Pila orbata* (Perry, 1811) is an earlier name for *Ampullaria globosa* Swainson (1822), and that *Ampullaria rotundata* Say (1827) is also a synonym of *Pila orbata* (Perry).

I am deeply indebted to Dr. J. C. Bequaert for drawing my attention to the correct date and other details of the publication of *Pomacea*, and to Dr. H. A. Pilsbry for honouring me with his opinion on the subject.

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MOLLUSCA ON SCOTTISH MOUNTAINS.

By W. Russell Hunter and Myra Russell Hunter.

(*Read before the Society*, 15 *October* 1955.)

On 16 June 1955 a single specimen of *Limax* (*Lehmannia*) *marginatus* Müller was found at a height of just over 3,100 feet near the summit of Sgor nam Fiannaidh, the peak at the western end of the ridge of Aonach Eagach, which forms the northern wall of Glencoe (vice-county 98, Main Argyll). No other slugs or snails were seen at this height anywhere on the ridge, but no deliberate search was made and the conditions were dry. *Arion ater* (L.) occurred on the slopes to the south and west of Sgor nam Fiannaidh up to a height of approximately 2,900 feet, and was abundant below 2,500 feet. Similarly Roebuck (1916, *Scot. Nat.*, 80) noted the same two species from Ben Alder (vice-county 97, Westerness) at a height of 2,500 feet. However, altitude records of Mollusca from those few Scottish mountains where calcareous rocks break down to give basic soils *do* include several snails. Laidlaw (1908, *J. Conch.* **12**, 192) and more recently Stelfox (1952, *J. Conch.* **23**, 271–272) record *Arianta arbustorum* (L.), *Clausilia bidentata* (Ström) and *Vitrina pellucida* (Müller) above 3,000 feet, and *Vitrea crystallina* (Müller), *Helix* (*Cepaea*) *hortensis* Müller, *H.* (*C.*) *nemoralis* L. and *Hygromia hispida* (L.) at heights of 2,000 feet and over, in the Ben Lawers group (vice-county 88, Mid Perth). In July 1954, the present writers noted *Helix* (*Cepaea*) *hortensis* Müller, *Discus rotundatus* (Müller) and *Oxychilus alliarius* (Miller) at a height of over 3,050 feet on Ben Laoigh (actually on the Stob Garbh ridge in Mid Perth, the southern and western faces of the mountain lying in West Perth, vice-county 87, and Main Argyll respectively). Both the Ben Lawers group and Ben Laoigh have rocks providing pockets of calcareous soil at high altitudes and both are famed for the wealth of alpine and subalpine plants growing on them. It appears that some snail species, more or less indifferent to the absence of lime at low levels, become increasingly calciphile high on Scottish mountains, as Boycott and Oldham (1936, *Scot. Nat.*, 47–52 and 65–71) noted some species to change towards the north of Scotland. Increase in latitude or in altitude (i.e. increasingly adverse climate) seems to raise the minimum calcium requirements of several species.

The Hill Collection.—Information has been received from Miss D. Hill that the shell collection made by her father, the late William Hill, is now in Buxton Museum.

Marine aliens in Cornwall.—R. H. Baird (*Nature* **175**, 954), records a living example of *Callochiton fulvus* (Wood), 55 mm. in length, from the river Fal, found attached to an oyster shell dredged in 3 to 4 fathoms in Tolverne Reach. This species occurs on the coasts of the Iberian peninsula and South America. *Crepidula fornicata* (L.) has been known in the Fal since 1947.

N. F. McMillan.

A TIDAL FLAT ON THE VERMILION SEA.

By S. STILLMAN BERRY (Redlands, California).

(*Read before the Society*, 15 *October* 1955.)

CHOLLA COVE, the southern indentation of the great Bahia de Adair in northern Sonora, is, to one interested in marine natural history, a remarkable bit of shore indeed, its fauna rich and varied far beyond the experience of one familiar only with the ordinary mud-flat of less favoured climes. It is big enough moreover, not only to sustain a large fauna (several hundred species), but to offer so wide a variety of exposure and terrain as to furnish the observer with representative segments of an unusual number of diverse inter-tidal associations. Such an area is therefore well worthy of some special attention. It is not easy to decide just what to call this wide tract of water, mud, and sand, for it is a tract of water at least part of the time. Quite commonly one hears it called rather carelessly Cholla Bay, yet it is not at all a true bay—at low tide it is scarcely even an indentation. I have gradually come to call it, and have just called it, Cholla Cove. It is more that, perhaps, than a bay, yet I am not at all sure that, strictly speaking, it is properly even a cove. It shares many of the features of a marine playa, with a small landward estero at its head. I would much like to know how the nearby Mexican folk denominate it. The first time I unrolled a sleeping bag here our camp was well up against the backwater of the estero. At extreme high tide the silent rise crept within a few feet of my bed ; at low tide one had to tramp across the mud flat perhaps a mile and a half or two miles to reach the outer reefs. The outgoing water fades away at the end almost before one's eyes ; the incoming flows like a river, and one is wise to remain sufficiently alert not to be overtaken by it.

Theoretically the conditions of life on a tidal flat like this ought to be less favourable than on a tide-pool terrain or in the sub-tidal zone, at least when we consider the prolonged recurrent exposures to air and the heat of the sun, the occasional thorough drenching by fresh-water during heavy rains (not, perhaps, so powerful a factor on this particular playa with its dry desert hinterland), the lack of shelter other than that afforded by sand or mud, and the scantiness of plant growth above the unicellular level, which greatly limits the variety and perhaps likewise the quantity of available food. Except for the burrowers the inhabitants of such a flat must then above all else be both euryhaline and eurythermal, perchance after all mainly a matter of adaptation to these very conditions. Next to the lowly plants, the burrowers are probably the basic element. These are mostly mucus feeders, retiring snugly within their chambers when the flat is exposed to the air, and extending forth when the tidal inflow sweeps over them to bring a fresh and rich supply of their required food. Upon these prey the carnivores, especially those voracious savages, the stenoglossate gastropods, comprising in this region mainly muricids, columbellids, nassariids, buccinids, olivids, conids, turrids, and terebrids. These are all ploughers and crawlers which become active upon return of tide. Simultaneously there come swimmimg in the various nectonic predators, such as rays, bony fishes, and octopi, which swim out with the tide again as it ebbs. Such an environmental complex forms an evident gradient, but, with such extreme differences necessarily prevailing between the conditions at low tide with the briefest and most incomplete desiccation and those at high water with almost equally brief periods of submersion, it becomes obvious that the principal elements leading from a simple gradient to true biotic zonation are likewise amply present. This is indeed the situation as we actually find it.

In the upper stretches, what we may call the shallow back-water of the playa with the shortest period of submersion, is a region of flat sloughs which are very messy when wet but get considerably dried during the exposed periods. These are covered with a fairly heavy growth of haline plants such as *Salicornia*, and everywhere are to be seen the empty shells of the small semi-terrestrial ellobiid pulmonate, *Melampus* (*s.l.*). The living snails are more difficult to find, probably because our search has not been sufficiently intensive to reveal their lurking places, or to discover the possible presence of other small mollusks of more or less similar habit, for example, *Marinula* and *Assiminea*, shells of which occasionally turn up in siftings taken further down on the flat.

Just below the *Melampus-Salicornia* zone is an extensive area of black mud, very retentive of moisture, and provided in its upper reaches with occasional troughs and swales holding back more or less water. This muddy area may have some interesting burrowers in it—my chief concern has thus far been with the lower levels and I have not dug in these higher ones ; its surface, however, is almost literally paved with quite incredible numbers of the black *Cerithidea mazatlanica* Carpenter. We pick our way down through this and after a time come abruptly upon a rather cleaner tract covered with another *Cerithidea*, this time the larger, much paler, more strongly variced, and heavier shelled *C. albonodosa* Carpenter, as we must at present call it. Bequaert places both of these under *C. hegewischii* (Philippi), the while giving *albonodosa* varietal rank. None the less these two Sonoran forms appear clearly separable, occupying distinct, if closely adjacent, habitats, and with a narrow belt of mingling at the contact without the slightest loss of separate indentity. They may be separated at a glance as fast as one picks them up, and I have yet to encounter even one individual that could certainly be interpreted as an intergrade. Even the mass effect as they lie in swathes on the mud is in each case distinctive.

The Cerithidea belt extends well down the sides of the playa, but more centrally it gives way to a deep winding lagoon or estero which always contains enough water to float boats of low draught and supports quite a fish fauna. Mexican dredging boats are often at work here, but whether for oysters or clams I did not discover. The slopes of the estero are great places for pelecypods of various sorts, particularly *Protothaca grata*, *Chione californiensis*, *Chione fluctifraga*, *Cardium procerum*, and *Heterodonax bimaculatus*. During our camp in this higher region the boys were able to replenish our larder very handily from the nearby estero.

Below this is the tremendous exposure of sandy mud-flat already described, threaded between tides by ever changing runnels and drainage channels carrying the outflow from the falling waters of the estero. Here the variety of life soon becomes greater: first, rather murky patches of shells of *Modiolus guyanensis* and *Tagelus californianus* (living ones less in evidence and must be searched for), then a cleaner area where many interesting items are represented as shells on the surface or may be dug from the substrate—*Dosinia dunkeri*, *Cyclinella singleyi*, *Chione gnidia*, *pulicaria*, and *purpurissata* perhaps, *Macoma indentata* and *pacis*, several species of *Tellina*, an *Apolymetis*, *Semele guaymasensis*, *Solen rosaceus*, and *Cryptomya californica*. *Theodoxus luteofasciatus*, *Cerithium stercus-muscarum*, and two small species of *Nassarius* occur in countless numbers ploughing through the surface-layer, and *Polinices uber* is also common here. Sometimes a big *Pinna* or an *Atrina* (both of which inhabit the flat) may be taken, and every now and then one picks up a complete shell of the infrequently seen *Solecardia eburnea*, the richly hued *Tellina simulans*, the exquisitely lovely *T. crystallina*, the strangely formed *Tellidora burnetti*, so well figured in the old *Zoological Journal* at the time of its first description, or the large fragile *Labiosa* (*Raeta*) *undulata*, although living ones may be quite another matter. By careful screening in likely spots scores upon scores of minute species will be brought to light—several scaphopods including a four-sided one, a few tiny taxodonts, the lesser Lucinidae, Veneridae, and Tellinidae, *Crassinella*, leptonids, and *Corbula* of several kinds, a host of oddly formed Vitrinellidae, Rissoidae, Triphoridae, Caecidae, Pyramidellidae in amazing diversity, and diminutive opisthobranchs belonging to many genera, as well as Eulimidae, Marginellidae, *Cerithiopsis*, *Tricolia*, bizarre forms such as *Macromphalina*, and various minor turrids allied to *Mangelia*. In the runnels are several species of *Nassarius*, *Hanetia pallida* (if it is the right time of the year you may find this creature carrying about its urn-shaped egg-capsules affixed to its own shell), several Chiones and Cardiums (*s.l.*), and, as the outer strand is approached, two dainty species of *Donax* are common, whilst a number of striking turrids, cones, and *Terebrae* appear, particularly during night hours. Meanwhile large shells of *Bulla gouldiana* have been noticed scattered about over the flat, but I have not found their true haunt. It is probably somewhere up toward the backwater.

At extreme low tide the outer strand offers a number of interesting faunal associations of its own. This is the region *par excellence* for beautiful Olividae in three genera and perhaps half a dozen species, including the striking *Agaronia testacea*, for those giants of their kind, *Dosinia ponderosa*, *Laevicardium elatum*, and *Macrocallista squalida*, and for *Strombus gracilior*, *Melongena patula*, *Murex nigritus*, and *M. erythrostoma*, all so persecuted by the commercial collecters, as well as for more cones and terebras. It is a surprising spectacle to see an immense clumsy *Laevicardium* pop up out of the sand under its own power. Anchored deeply by attachment to a pebble or some old shell is the queer "*Vermetus*" *tripsychus* Pilsbry and Lowe, while more rarely seen is the equally extraordinary *Aletes* (?) *eruciformis* (Mörch). Here in the water's edge is the special home of the wonderful little shell-inhabiting *Octopus digueti* Perrier and Rochebrune, and during their breeding season it is here that we look for assemblages of the magnificent *Turritella goniostoma broderipiana* crawling along at tide-line, or sometimes collecting head-on in star-shaped groups in shallow water to emit their great strings of ova. The beautiful *T. leucostoma* may come in at some seasons in the same manner, for hermit-crab shells of it are not infrequent. The Gulf form of *Neverita recluziana* is a common crawler on the strand, but the more colourful *Polinices bifasciata* is relatively rare. In places certain echinoids of the flat " key-hole " type occur in utmost abundance and so closely tessellated in broad patches that one cannot step without crushing them. An occasional example may be found infested with parasitic styliferids, while old bleached shells often contain interesting small borers such as *Spengleria* or *Diplodonta* (here rather more than a mere nestler in habit), or, like some of the old *Dosinia* valves, they may afford refuge to a small chiton or so, the commonest being *Ischnochiton eucosmius* Dall. The interior of empty clam-valves also provides shelter for a fine *Calyptraea* or for *Crucibulum* in two species. Several species of *Crepidula* are found on the shells of such gastropods as *Murex*, with *Crucibulum* also sometimes occurring there. A curious site for *Crepidula onyx* is on the large Turritellas just behind the aperture. Away out at extreme low tide a few low banks of fossiliferous reef are exposed. Here the dominant mollusks are *Cerithium stercus-muscarum*, clustering countlessly about, and a small but clumpy and moderately spectacular " *Petaloconchus* ", perhaps *contortus* Carpenter. A minute black *Anachis* likes to gather under old shells and bits of rough stone. Small *Turbo fluctuosus* with their striking opercula, fusinids, several species of *Calliostoma* and *Tegula* and the carnivore *Eupleura* may be found. If one is especially fortunate an occasional *Cancellaria*, or a chubby little operculate volute of the genus *Enaeta* will be encountered. Here and there in gaps between the reefs one may run across a patch of purple or white gorgonian, to the branches of which are affixed small specimens of *Pteria*, or they may now and then carry a beautiful *Neosimnia* closely matching its particular host gorgonian in colour.—But here a swirl at our feet warns that the tide has turned upon us. We must regretfully, but without delay, start the slow trudge back across the wet flat to our camp, as the westering light fades behind the sere peaks of La Providencia and limns the long crenate line of the Sierra San Pedro Mártir far across the Gulf, while soon in its own turn the gathering gloom dissolves away in the double glory of the rising moon and her reflection on the shimmering playa.

CYPRAEA IN NORTH-WEST MALAYA.

By Lt. Col. R. J. Griffiths.

(*Read before the Society*, 16 *April* 1955.)

From September 1953 to April 1954 I collected extensively on the Malayan island of Penang, on the neighbouring mainland, and on the small island of Pulau Bidan about 20 miles to the north. The coast of Penang has many sandy beaches, with rocky headlands and some artificial stone embankments, and with groups of large rocks partly buried in the sand. There are also some rocky stretches on the south coast of the island. The mainland consists of one long sandy beach, interrupted by stretches of mud near rivers, and by a few piers and jetties. Pulau Bidan is mainly rock, with a few small sandy beaches. The seawater in all these places has much fine mud in suspension, especially near Penang, and there are no coral reefs. In these areas four species of *Cypraea* were found living on rocks, embankments and a pier. The localities are listed below, the map references being to the General Staff Geographical Survey one inch to the mile map of Penang Island and Province Wellesley, 1950.

C. lamarckii Gray was collected in fair numbers on north Penang at 938777, 948776 and 952772, and on south Penang at 832553. It was observed to be in great profusion on south Penang at 823550, where hundreds of specimens were seen crawling on the rocks. Beach shells were picked up on north Penang at 855774 and on Pulau Bidan. One living specimen was observed on a concrete pier on the mainland at Butterworth, and was the only specimen of any species seen on the mainland in this part of Malaya. Oliviform specimens were collected on both north and south Penang, and in February 1954 eggs were found on south Penang.

C. pallida Gray. 11 living specimens and one beach shell were collected on north Penang at 9377 and 9477, and a beach shell was picked up at 855775. Eggs were found on 25 October 1953 at the first-named locality.

C. errones L. was taken in fairly small numbers on north Penang at 938777 and 948775, and a few specimens were found at 952722, 976727 and also on Pulau Bidan. Eggs were collected on 25 October 1953 at 938777 on north Penang.

C. arabica L. was present in large numbers on a sloping stone embankment on north Penang at 976727, and in small numbers on the north and south coasts at many other points. Large numbers of specimens were to be seen on Pulau Bidan. Eggs were found on Pulau Bidan in March 1954. Oliviform shells were collected on north Penang and on Pulau Bidan.

All living specimens were observed to inhabit rock and stones in the area between mean tide level and low water spring tide level, with *C. arabica* usually the first to be uncovered by the tide. *C. arabica* and *C. lamarckii* were evenly spread over the areas they inhabited, but *C. errones* often occurred in colonies covering only a few square yards. *C. arabica* was usually to be found in holes or crevices, while *C. lamarckii* was almost invariably to be seen crawling boldly about. *C. errones* and *C. pallida* were sometimes taken half-concealed in colonies of club-headed coelenterates, with mantle completely extended. In almost all other cases the mantles were mostly or completely retracted. Adult specimens of all species were often active, and crawled readily over the hand when captured; oliviform specimens were more timid, and were never persuaded to crawl or to protrude their mantle.

The eggs of all species were in round clusters about 20 mm. in diameter, and were usually deposited in slight concavities in the rock. They were in all cases identified by the presence upon them of a guardian adult.

It was observed that light tended to bleach the empty shells rapidly after collection, shells of *C. lamarckii*, for example, changing from dark grey to greyish brown in a matter of days. This suggests that comparisons drawn between species or subspecies on the basis of shades of colour may be misleading.

One specimen of *C. arabica*, apparently of some considerable age, was found with live barnacles about 4 mm. tall on its dorsum. One of these barnacles was covered with enamel (Plate 3). From this it appears that the extension of the mantle over the dorsum is by no means frequent in older specimens.

In Table I are given the size measurements of some of the shells collected, together with the calculated mean deviations of shells from the average dimensions. The mean deviation (m.d.) is the average difference of all shells from the mean dimension, and thus is an indication of size variation. Table II consists of histograms of the length of the shells; these show the size spread in individual localities and in the whole area. From these data some interesting conclusions may be drawn.

When a population in a local area is very large, the average individual size is seen to be smaller than the average size of individuals found in less populated areas. This is true of *C. arabica* found on Pulau Bidan and at 976727 on Penang, where specimens were on an average 15 mm. shorter than those from other localities. It is also true of *C. lamarckii* on south Penang, where the average difference in length between specimens from neighbouring areas was 5 mm. Here, however, the figures are less easily seen from Table II, owing to the tendency for the specimens of *C. lamarckii* on south Penang to be larger than those on the north of the island. The explanation of this variation of size with density of population is probably the increased competition for the available food in the more densely populated areas, but why some areas remain comparatively thinly occupied is not clear. A somewhat similar size variation has been observed with *C. tigris* L. in the Pacific (Harris, 1935).

Schilder and Schilder (1938, 1952) record two geographical races (subspecies) of *C. lamarckii*, which differ in size, colour of dorsum, ocellation of dorsal spots, curvature of aperture, shape of terminal ridge, fossular denticulation and width of lateral spotted zone. Comparison of shells from Penang with some from East Africa bears out the first and third of these points; the second also appears to be a constant point of difference, but because shells are prone to fade it is a dangerous one to use. The remaining points do not appear, on the basis of these Malayan and African shells, to be sufficiently marked or constant to be used for purposes of taxonomy.

C. pallida has not previously been recorded in Malaya, except for a possible record from Malacca which Schilder and Schilder discount (1952, p. 119). These specimens now found on Penang link geographically the two races nominated by Schilder and Schilder, and are, indeed, intermediate in size between them, but since I have seen no specimen of the eastern race, *C. p. insulicola* Schilder and Schilder, I am not able to make a racial comparison.

A specially interesting point is the great variation in groups of specimens of *C. arabica* taken from neighbouring localities. The extreme length spread of individual shells is from 31 to 67 mm., and, as may be seen from Plate 3, the variation in shape of dorsum, sides and ends is also considerable. Compared with specimens from 976727, shells from 937777 were half as big again, ovate in shape instead of semi-cylindrical, and proportionately about a tenth taller and broader. The range of the free-swimming larva, aided by tidal flow, is considerable, and is probably greater than the distances separating the groups of *C. arabica*, so that it is likely that the variations between the groups were mainly due to differences of environment. Genetic differences would have led to some degree of intermixture between the groups, but little intermixture of the more pronounced variations was observed. Some of the shells closely approach *C. eglantina* Duclos (Schilder and Schilder, 1952, Plate 2, and Plate 3 of this paper), and it is possible that this species may only be a form of *C. arabica*. This point needs further investigation.

Schilder and Schilder have separated *C. arabica* into seven geographical races (subspecies), distinguished by size, by shape of dorsum, ends, sides and base, by colour, and by number of teeth. The race nominated for the Penang area is *C. a. dilacerata* Schilder and Schilder. The great local variation of *C. arabica* seems to mask the listed differences between the races, and specimens from Malayan localities only a few miles apart appear to show greater variation than those described by Schilder and Schilder in their world-wide races. While the theory of the subdivision of species into geographical subspecies is now generally accepted (Huxley, 1942), the large size and shape spread of these Malayan specimens shows that, for species subject to great variation, large numbers of specimens from many precisely known localities must be examined before subspecies can be accurately determined.

It only remains to add that I have preserved specimens of all four species, together with their eggs, and that these are available for further study.

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Table I—Shell Dimensions.

A. *Individual Localities.*

Species	Locality	No of shells measured	Mean size in mm.			Mean breadth and height as % of mean length		Mean number of basal teeth	
			length	breadth	height	breadth	height	labial	columellar
C. lamarckii	N. Pg. 952772	5	29	19	14	66	48	14	14
	948776	11	28	19	15	68	54	14	13
	938777	14	29	19	15	66	52	15	14
	S. Pg. 832553	11	33	21	17	64	51	16	14
	823500	23	28	18	14	64	50	15	14
	P. Bidan	2	32	23	18	72	56	14	14
C. pallida .	N. Pg.	11	24	15	12	63	50	15	14
C. errones .	N. Pg. 952722	3	25	15	12	60	48	12	14
	948775	11	24	14	11	58	46	12	14
	P. Bidan	3	22	13	10	59	46	12	14
C. arabica .	N. Pg. 979726	5	52	32	25	62	48	23	25
	976727	16	40	23	18	58	45	21	22
	948774	4	57	34	27	60	47	25	28
	942776	3	46	27	22	59	48	23	24
	937777	5	60	38	31	63	52	25	26
	852775	2	50	29	23	58	46	22	24
	S. Pg. 832553	2	61	36	28	59	46	24	27
	823550	2	62	35	28	56	45	26	28
	P. Bidan	13	40	23	19	58	48	22	24

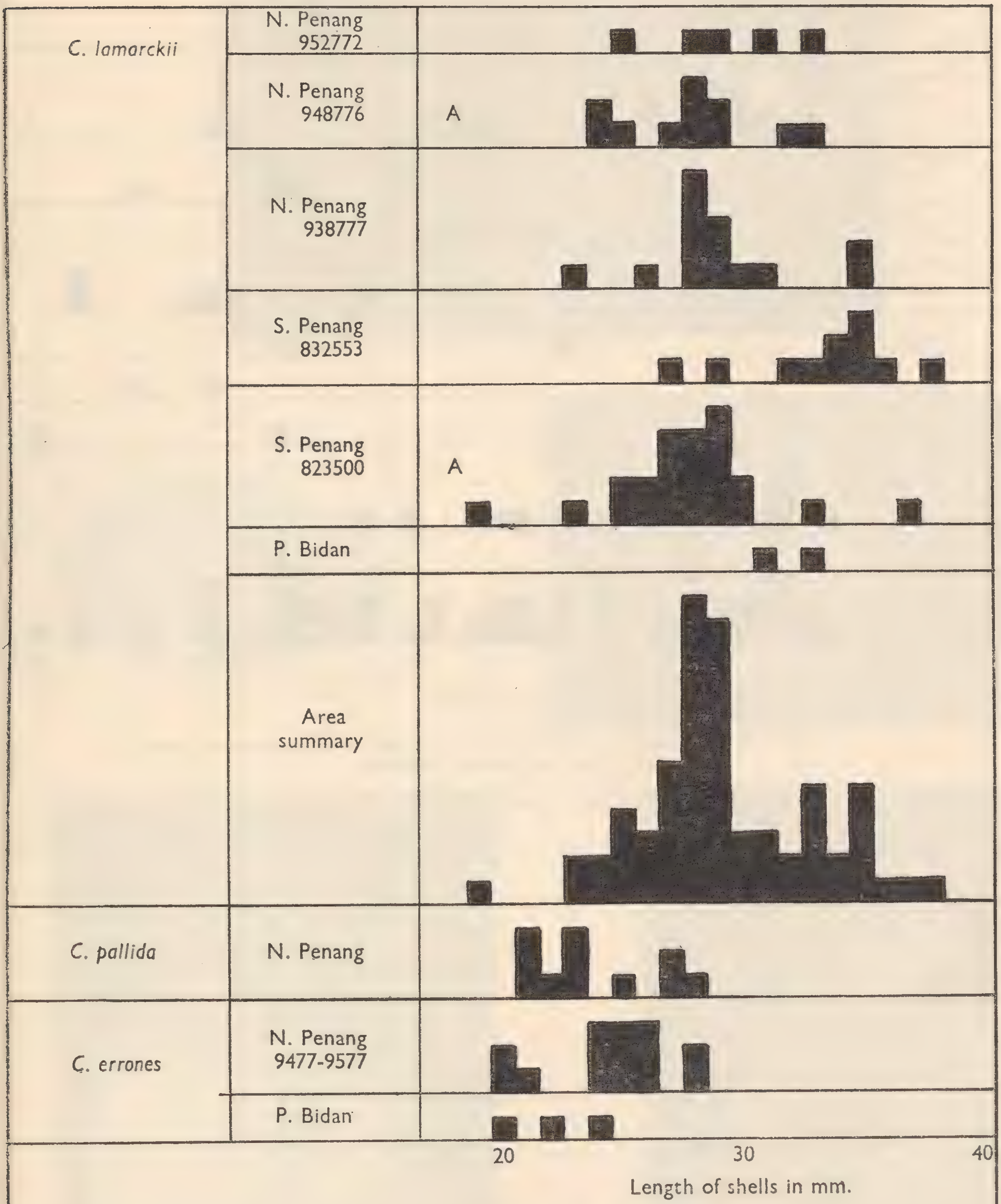
B. *General Area.*

Species	Mean size			Maximum size			Minimum size			Mean breadth and height as % of mean length	
	l.	b.	h.	l.	b.	h.	l.	b.	h.	b.	h.
C. lamarckii . .	29	19	15	38	23	19	19	13	10	66	52
C. pallida . .	24	15	12	28	17	13	21	13	10	63	50
C. errones . .	24	14	11	28	17	13	20	12	9½	58	46
C. arabica . .	47	28	22	67	37	29	31	18	14	60	47
				65	43	32					

Species	M.ds. mean size			M.ds. as % of l, b, and h			Mean % m.d.	Mean no. of basal teeth	
	l.	b.	h.	l.	b.	h.		labial	columellar
C. lamarckii . .	2·7	1·8	1·4	9	9	9	9	15	14
C. pallida . .	2·4	1·4	0·9	10	9	8	9	15	14
C. errones . .	1·9	1·0	0·9	8	7	8	8	12	14
C. arabica . .	9·0	5·3	4·7	19	19	21	20	23	24

Notes. 1. The mean size was obtained as an average of all the shells listed in part A of this Table.
2. The mean deviation (m.d.) is the mean of all individual differences from the average sizes, and thus gives an indication of the variation in size.

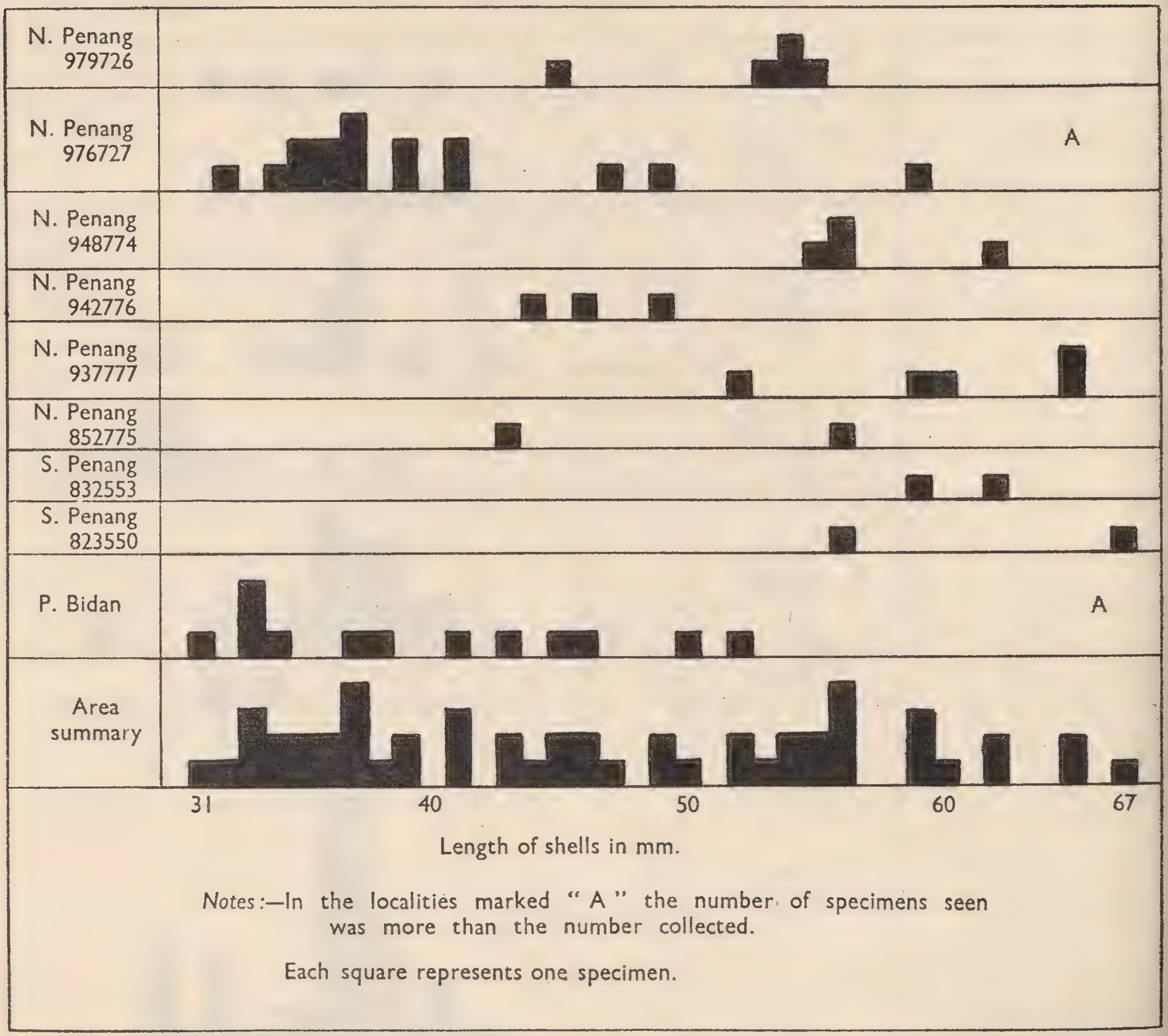
Table IIa—Length Histograms for *C. lamarckii*, *C. pallida* and *C. errones*.



Notes:—In the localities marked " A " the number of specimens seen was more than the number collected.

Each square represents one specimen.

TABLE IIb—Length Histogram for *C. arabica.*

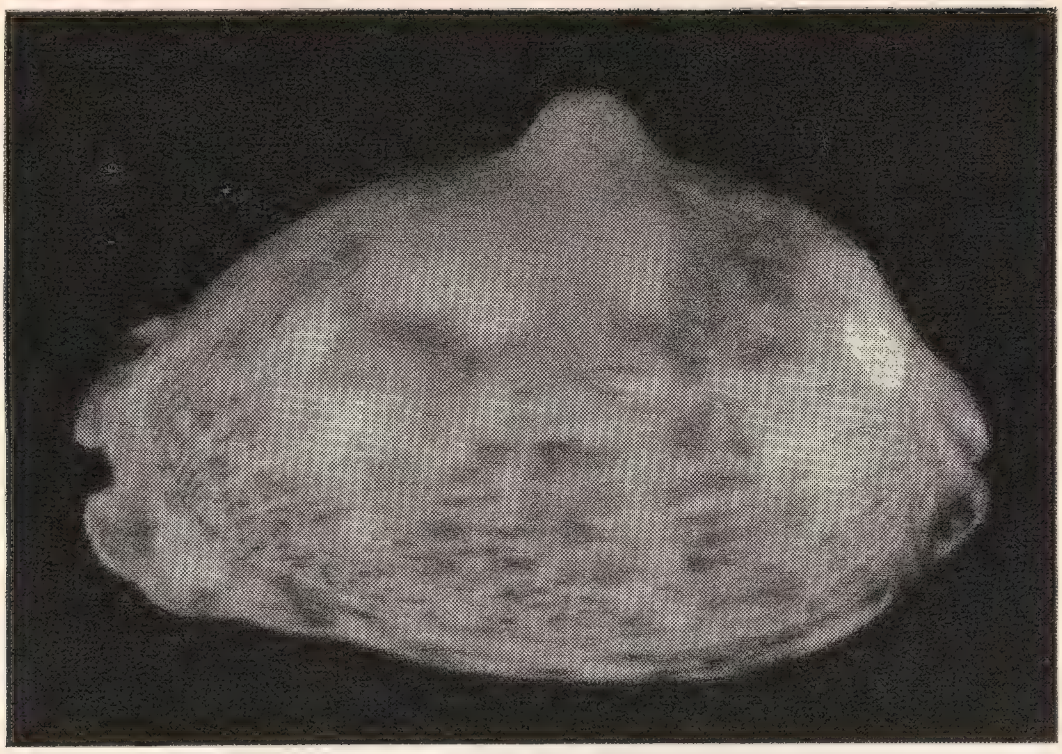


Notes:—In the localities marked " A " the number of specimens seen was more than the number collected.

Each square represents one specimen.

EXPLANATION OF PLATE 3.

FIGURE 1.—*Cypraea arabica* L. North Penang, 948775 (with enamel covered barnacle on dorsum).
FIGURE 2.—*C. eglantina* Duclos. From Zoological Museum, Berlin.
FIGURE 3.—*C. arabica* L. Pulau Bidan.
FIGURE 4.—*C. arabica* L. North Penang, 937777.
FIGURE 5.—*C. arabica* L. South Penang, 823550.
FIGURE 2, × $\frac{3}{4}$; FIGURES 1 and 3–5, natural size.



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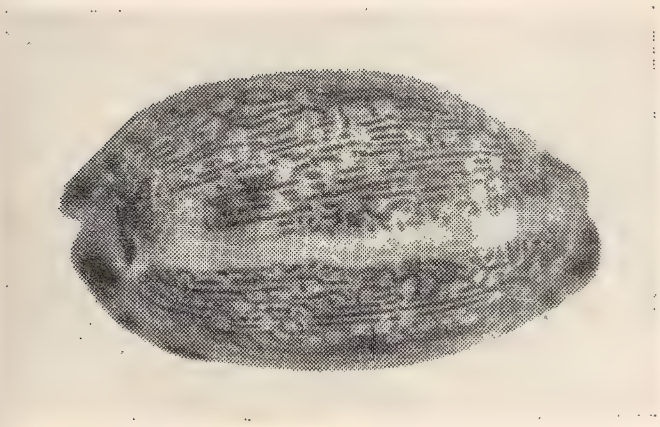

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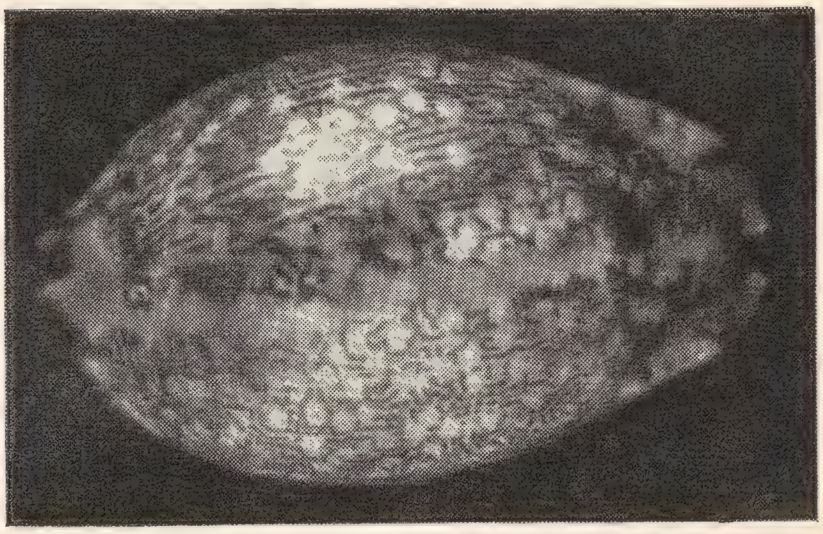

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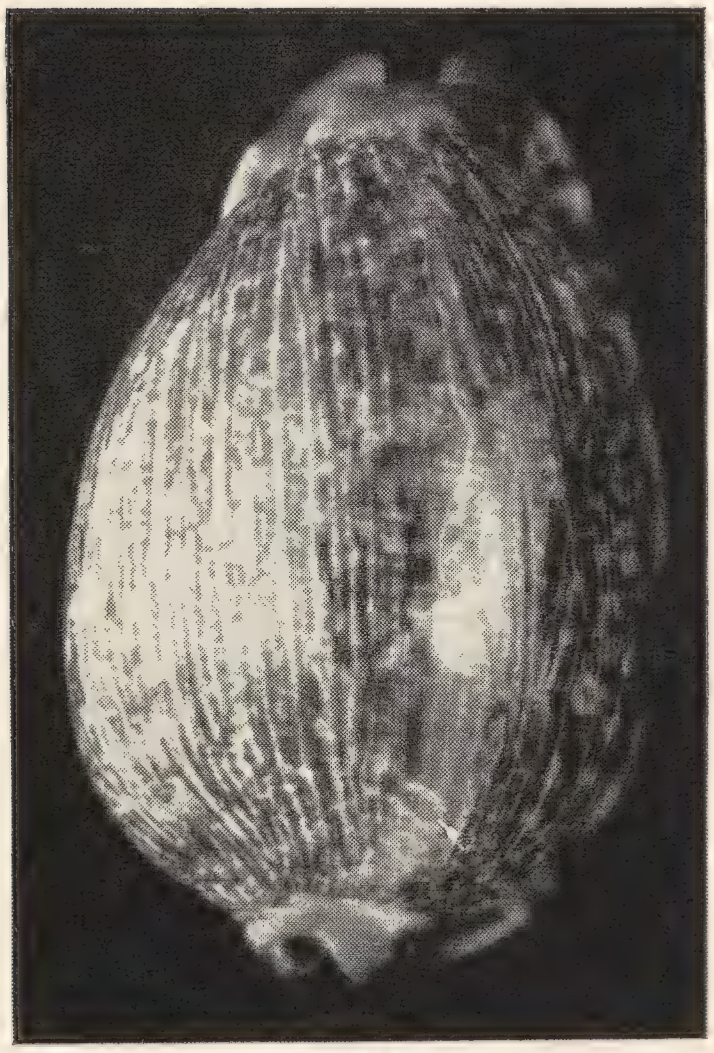

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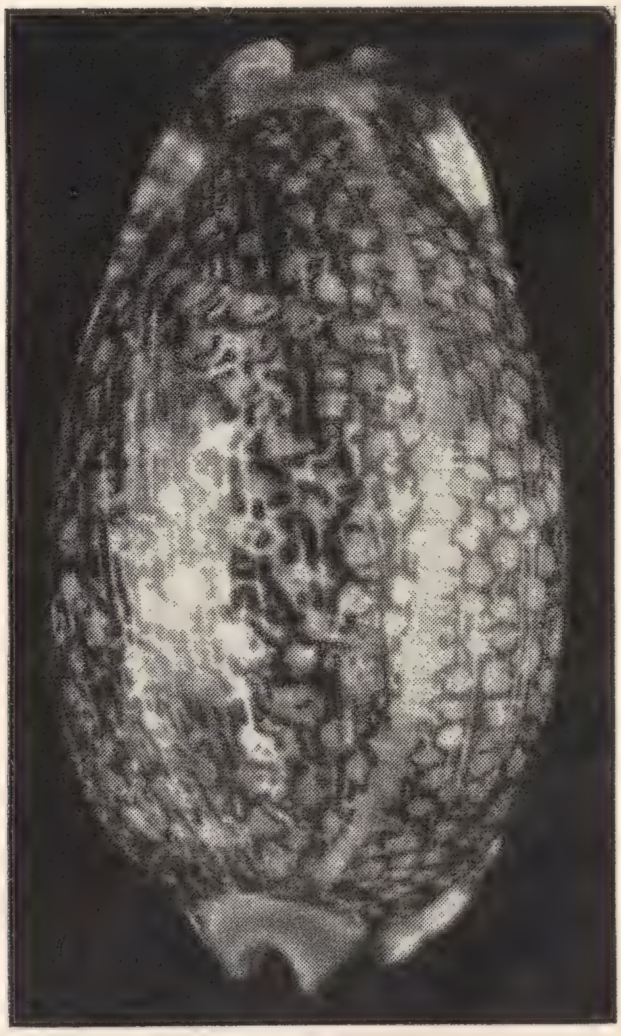

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Malayan *Cypraea*.

[*To face page* 90

A NEW SUSSEX LOCALITY FOR *PISIDIUM PSEUDOSPHAERIUM* FAVRE.

By S. P. Dance.

(*Read before the Society*, 15 *October* 1955.)

Since the publication of Kuiper's paper (1949) on the occurrence of *Pisidium pseudosphaerium* Favre at Pevensey, Sussex, the only addition to our knowledge of this rare lamellibranch in the British Isles has been a new locality record for Glastonbury, Somerset, taken by H. Overton in 1906 (Ellis, 1950). Nothing has been written concerning the ecology of this species in these islands beyond Kuiper's paper. On the Continent it is known from very few localities and only in Holland has its ecology been well observed (Jutting and Kuiper, 1942; Kuiper, 1947).

Mr. A. E. Ellis wrote me concerning this species (26 March 1955) " One would expect to find it at Lewes and Amberley in Sussex, and the Norfolk Broads district, but I have failed to find it there ". Having collected *P. pseudosphaerium* extensively in the marshes around Pevensey, I was struck by the similarity between the marsh drains there and those around Lewes in the valley of the Ouse, and decided to investigate the latter locality. Accordingly in April 1955 I searched in the marsh drains east of Iford, a village 2 miles south of Lewes. There, in a short time, I found many examples of *P. pseudosphaerium* and some other members of the genus. I collected in five loci and made a few notes concerning them.

The five loci were all marsh drains, four to the south and one to the north of the path running north-east from Iford to Rise Barn, the northernmost locus distant some 400 yards from the southernmost. Four species of *Pisidium* were encountered, viz: *P. obtusale* (Lamarck), *P. milium* Held, *P. nitidum* Jenyns and *P. pseudosphaerium* Favre. *P. pseudosphaerium* occurred in two loci unaccompanied by any other species of *Pisidium* and in one in association with *P. milium* and *P. nitidum*. The other two loci yielded only *P. obtusale*. Kuiper (1949, 30) remarks " *P. pseudosphaerium* . . . . has been collected only in clear, stagnant, often densely vegetated swamps and peaty ditches ". In the Pevensey marshes I have found it almost invariably in very stagnant marsh drains, densely vegetated or with a thick layer of decaying matter on the bottom. Where the Iford examples occurred alone the ditch was densely vegetated and they were found mostly among submerged grass stems growing at the sides of the drain. It is interesting to note, therefore, that where *P. pseudosphaerium* occurred with *P. milium* and *P. nitidum* the character of the drain was markedly different. There was not a vestige of living vegetation on the bottom or the sides of the drain, which was also much shallower and muddier than the other drain to which it was directly connected. Apparently it had been cleared of weed some time ago, as rotting aquatic vegetation and bleached shells of aquatic snails were strewn on either side. *P. milium* and *P. nitidum* occurred in about equal numbers and were much more common than *P. pseudosphaerium*. The shells of all specimens taken were remarkably glossy and only one or two examples of *P. pseudosphaerium* bore any trace of the incrustation which Kuiper (1949, 30) says "frequently covers the whole shell". Some of the *P. milium* also had traces of deposit. I have seen many examples of *P. pseudosphaerium* from Pevensey completely covered with an incrustation of micro-organisms. None of the *P. nitidum* bore any trace of deposit. I could detect no difference whatever in the striae of the three species and only vague indications of the nepionic grooves usually so characteristic of *P. nitidum* in more favourable habitats. The largest *P. milium* was no larger than the largest *P. pseudosphaerium*, and *P. nitidum* only slightly smaller. I think that the paucity of *P. pseudosphaerium* here was directly due to the clearance of the vegetation and that the *P. milium*, *P. nitidum* association was fast becoming established in an environment made favourable thereby. The following species were found with *P. pseudosphaerium* : *Lymnaea peregra* (Müller), *L. palustris* (Müller), *Physa fontinalis* (L.), *Bithynia tentaculata* (L.), *Planorbis planorbis* (L.), *P. contortus* (L.) and *Sphaerium corneum* (L.).

The drains where *P. obtusale* occurred were not so densely vegetated but were more stagnant. One of the drains contained countless numbers of *Planorbis* and the *P. obtusale* were found in floating masses of weeds associated with *Planorbis corneus* (L.), *P. planorbis*, *P. vortex* (L.), *P. contortus*, *Segmentina complanata* (L.), *Bithynia tentaculata* and *Sphaerium corneum*. *Physa fontinalis* was present in the other *P. obtusale* locus.

Further collecting in the south of England and elsewhere will, I am sure, show that this *Pisidium* occurs in other low marshy areas, such as those at Pevensey and Iford.

For checking my determinations of *Pisidium* and for helpful criticism of this paper I am indebted to Mr. A. E. Ellis, and for his precious advice on all points touching this critical group I must thank Mr. A. W. Stelfox.

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TWO FORMS OF *LYMNAEA AURICULARIA* (L.) IN ONE POND.

By N. F. McMillan.

(*Read before the Society,* 19 *November* 1955.)

Lymnaea auricularia comprises several forms varying much in shell-shape, from a long-spired and relatively narrow shell to a squat shell with a greatly expanded body whorl. The former has been separated as var. *acuta* Jeffreys and the latter is usually regarded as the typical form. The purpose of this note is to draw attention to the occurrence of two distinct forms of *L. auricularia* in one pond, and the apparent absence of intermediates between them.

The pond in question is about ¾ mile west of Spital railway station, in the Wirral peninsula, Cheshire, in the grounds of " Heathfield ". At the end of the last century two small and one large water-filled marl-pits existed, according to the 6 inch O.S. map, Cheshire Sheet 22 N.E. (2nd. ed.), and later, when the house was built, the pits were included in the gardens. At some time (presumably when the gardens were laid out) the pits were metamorphosed into two large connected ponds of the " ornamental water " type, their margins tidied with boarded edges and a few water-plants (notably *Cyperus longus* L.) planted. In addition they were largely filled with builder's rubbish—bricks, etc.—leaving a level bottom covered with a maximum depth (since 1948 at any rate) of about 18 inches of water. Each pond was approximately 110 ft. square.

In August 1948 the ponds were first visited and at this time the following snails were taken: *Planorbis planorbis* (L.) fairly frequent, *Lymnaea peregra* (Müller), only a few, and *L. auricularia* (L.) var. *acuta* Jeffreys, abundant in one place, and specimens apparently mature, although not large. Except for the *Cyperus* there were no plants, but at the north end was a small bay with red water-lilies, and here only occurred the *L. auricularia* recorded above. At this time I put the general scarcity of snails down to the lack of plants, as the ponds looked suitable habitats otherwise.

Unfortunately as the ponds were in private grounds they were not visited frequently, but in 1955 a series of visits were made, as the estate is being " developed " as a new housing estate, the house demolished and the ponds filled in. In April the ponds, though holding water, still showed cracks in their mud bottom and bleached shells of *Lymnaea* spp. were abundant. *P. planorbis* was still fairly frequent, alive, and a single large *L. auricularia* var. *acuta* was taken alive, together with a few *Pisidium* sp. Gammarids were also noted. By August the ponds were quite dry and the bottom deeply fissured, showing that only one or two cms. of mud overlaid the " filling " of bricks and rubbish. Pisidia formed a zone several inches wide round the edge, just below the April water-level. In September plants were colonizing the bare mud; *Alisma* was thinly scattered everywhere, *Sparganium ramosum* formed a bed in one place, and *Equisetum palustre* appeared to be spreading rapidly. In addition the ubiquitous coltsfoot was widely spread, together with *Epilobium hirsutum*, and two species of *Juncus*.

At this time a collection of about 200 specimens of the dead *Lymnaea* shells was made in the southern pond (the other yielded few shells and was almost all filled up in any case), and it was seen that two forms of *L. auricularia* were present in almost equal numbers. *L. peregra* was represented by only two shells. Of the two *L. auricularia* forms one was that normal to the Wirral ponds, with a short sharp spire and a fairly wide mouth, though it is not the shell with the greatly expanded body-whorl characteristic of *L. auricularia* in southern England. The other form was an extreme state of var. *acuta*, exactly matching shells from Arland's Lough, W. Donegal, figured by Stelfox (*Proc. Roy. Irish Acad.* **29** B, pl. 7, fig. 15, 1911). This form occurred thickly spread over the lower part of the pond, but only sparingly elsewhere, and has not been taken alive at all. The " normal " form, so called for convenience although it is much smaller than the large shell regarded as typical *L. auricularia*, has been taken alive in both 1948 and 1955. An interesting point is that no intermediates were found ; all the shells could easily be sorted into one or the other group.

The occurrence of two such different forms in the same pond raises various questions, but it seems possible that the pond has dried up more than once, and var. *acuta* was exterminated during one of these periods. Presumably this was pre-1948, as only the " normal " form was taken alive in that year. Both 1947 and 1949 were " drought " years, and var. *acuta* is largely concentrated in a very slightly deeper part of the pond, no doubt having followed the shrinking water-level. If this supposition is correct, then the " normal " form has either died out also—witness the abundant shells scattered all over the pond floor—and then recolonized the pond from another source, or managed to survive and then increased in numbers with more favourable conditions.

It seems curious that *P. planorbis* has apparently survived droughts better than *L. auricularia*, but no data seem to be available on the relative resistance to desiccation of the various freshwater species, except those of medical or veterinary importance.

Postcript.

Although *L. auricularia* (L.) var. *acuta* Jeffreys occurs in some of the Wirral ponds (compared with specimens authenticated by Kennard), the extreme form called var. *acuta* in the above note certainly does not, nor is it represented in the Standen-Jackson collection, now in Liverpool Museums.

A NEW SPECIES OF *CORILLA* FROM CEYLON.

By G. A. S. Barnacle.

(*Read before the Society,* 15 *October* 1955.)

In June 1911, the two shells which are the subject of this paper were found by the author on the underside of leaves of cardamom plants growing in heavy jungle from which the smaller trees and undergrowth had been removed. The situation was towards the summit of a hill amongst the foothills of the north-western part of the central mountain range, i.e., the western part of the Dolosbage District ; a remote spot with no road nearer than three miles away, in the valley of the Kelani River nearly 2000 ft. below. Climate extremely wet, average 300 inches of rain per annum.

On recent comparison with specimens of this genus in the collections of the British Museum (Natural History), the Zoologisch Museum, Amsterdam, the Rijksmuseum van Naturalijke Historie, Leiden, and the private collection of Mr. Arthur Blok, it was found that there was nothing resembling them, with the sole exception of the species *beddomeae* (Hanley), which however differs in many respects. Published descriptions of species of the genus reveal that this new species has hitherto been undescribed.

Corilla lesleyae n.sp.

Shell widely umbilicate, rotundate, discoid, chestnut-brown, shining, somewhat widely and irregularly costate or wrinkled. Spire plane, suture impressed. Whorls 5–5½, flattened above, tumid below, not carinated ; the last whorl rising slightly above the plane of the spire and then descending steeply and expanding towards the mouth. There are traces of several fine thread-like lines of spiral sculpture on the upper part of the whorls, chiefly near the suture, the outermost of these showing most distinctly on the paratype as a whitish band of pigment almost ¼ mm. wide in the hollows between the wrinkles, round the last whorl above the periphery. Aperture widely dilated, oblique, almost horizontal, elliptic ovate ; peristome whitish, thickened and broadly reflexed, a slight parietal callus joining the margins. Umbilical area moderately deep with a rounded margin. Parietal folds two, just visible from the aperture, the upper one long and descending posteriorly, but having no connection whatever with the parietal callus ; below this a shorter fold parallel with the upper one. Palatal folds four, all visible from the aperture, the three upper ones short, about 1½–2½ mm., almost horizontal and nearly parallel, equidistant and attenuated anteriorly, each slightly shorter than the one above it, the outer terminations forming an oblique line as each is successively deeper within the shell, the uppermost being most forward ; the fourth fold subparallel with the suture, about the same length, but terminating nearer the aperture than the fold above it.

Habitat :—Ceylon : Ullswater Estate, near Kitulgala, 2000 ft.
Holotype :—Major diam. 18, minor 14, alt. 6·5 mm.
Paratype :—Major diam. 16·5, minor 13, alt. 6·5 mm.
Both in the British Museum (Natural History).

In comparison with the nearest species *C. beddomeae* (Hanley), the new shell has a much wider, more expanded and more horizontal aperture, thicker and more reflected peristome, no parietal fold connected with the parietal callus, and the palatal folds are nearly horizontal, whereas they are decidedly oblique in *C. beddomeae*. The whorls, 5–5½, compared with 5½–6, are not carinated at or above the periphery, and the suture is deeper and more distinct, the whorls being slightly convex above and not flat as in *C. beddomeae*. The costae or wrinkles are wider apart and coarser and the undulation of the last whorl before descending to the aperture is in contrast to the uniform and gradual descent of the whorl in *C. beddomeae*.

My thanks are due for help in determination of the species to Mevr. W. S. S. Van der Feen, to Mr. Arthur Blok, and to Mr. G. L. Wilkins.

I have named the species after my wife who has endured my conchological activities for many years.

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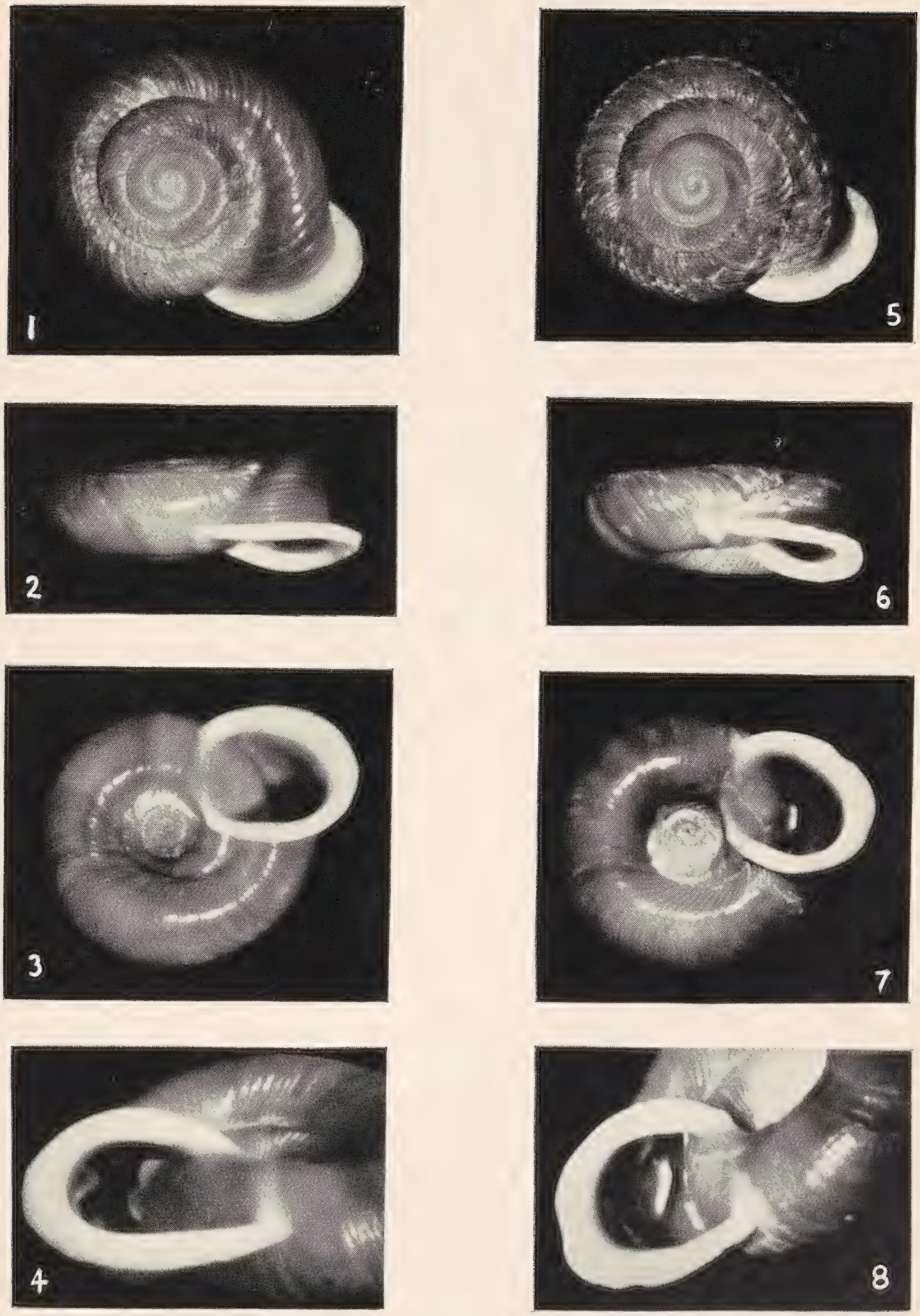
***Agriolimax reticulatus* (Müller) feeding on carrion.**—At the bottom of the steep banks of the dumble near Mansey Common, Eakring, Nottinghamshire, on 25 May 1955, I saw a number of young rabbits dead or dying from the disease myxomatosis. One of the recently dead rabbits had a large hole in the right side of the neck (which looked like the work of a rat): the cervical vertebrae were distinctly visible. In the hole a slug, *Agriolimax reticulatus*, was feeding, and five more slugs of the same species were converging on the rabbit.

(A feature of the Keuper area is the occurrence of numerous " dumbles," or dry, wooded ravines cut by small tributary streams through marl and skerry.)

G. W. PITCHFORD.



Corilla lesleyae : 1–4, Holotype, 5–8, Paratype.

MOLLUSCA IN THE ALLUVIA OF THE RIVER SIAGNE.

A. Comfort.

(*Read before the Society*, 19 *November* 1955.)

Alluvia of coastal rivers, especially the Siagne near Cannes, the Lez at Montpellier and the Loup at Cagnes-sur-Mer, are the only known source of a number of small species from the French meridional soil fauna and have been much examined. The Siagne alluvia are the type locality for the (unidentified) *Hohenwarthia macei* Bourguignat and for *Ferussacia intermedia* Caziot (Germain 1931).

Shells of 57 identifiable and at least 2 unidentified species of land and freshwater Mollusca were collected from the alluvia of the River Siagne at La Napoule, Alpes Maritimes, on two successive afternoons of collecting during May 1955. Most of the smaller species were obtained by sifting from about 250 gm. of small débris. The alluvia were most abundant along the west shore of the small creek skirting the golf links, and immediately adjacent to the bridge and coast road. They had been recently deposited, and the Mollusca accompanied the large drift and leaves forming banks on the beach and in the adjacent copse.

The listed species represent a mixture of geophile and soil Mollusca, with xerophilic forms from the coast plain and the dry hills around Grasse, and a few hygrophiles (*H. cinctella*, *H. obvoluta*), probably from patches of woodland and the walls of gorges. The white Helices show a discontinuous polymorphism which appears to be the rule in alluvial material, due no doubt to the mixture of individuals from several discrete colonies of different facies.

The most interesting record is a single *Pleuracme* (*Renea*). This is apparently *P.* (*Renea*) *moutoni* Dupuy, the type locality of which is Grasse (Dupuy 1851), about ten miles from La Napoule and close to the Siagne gorges. The specimen is without gloss but probably recent, and measures 3·8 × 1·1 mm. No specimens of *P. moutoni* could be traced in this country, and it does not seem to be in the Locard collection. Syntypes of the other French species of the subgenus, *P.* (*Renea*) *bourguignati* Nevill, from the quaternary of Menton, were given by Nevill to Godwin-Austen and have been traced in the Godwin-Austen collection. These are of the same length but more slender (4·0 × 0·8 mm.) and have more whorls : the absence of sculpture at the base of the body-whorl, given by Nevill and by Germain as a specific character, is not very evident in these shells, or in Nevill's figure. They are well represented by Germain (1931, 592, figs. 620–622). The third related species, *P.* (*Caziotia*) *singularis* Pollonera, is known only from the alluvia of the Loup at Cagnes, and is distinguished by its enormous sutural sinus. All these species are extremely uncommon in collections. They are confined to this corner of the Mediterranean littoral—their biology does not appear to have been investigated. Like many other species known only from single specimens they are probably extremely local—Dupuy's specimens of *P. moutoni* were found " under bushes " near Grasse, which gives no clue to any specialized habitat ; *P. bourguignati* was abundant, however, in Quaternary times. It has not been found alive.

List of Species.

Euconulus fulvus (Müller)
Oxychilus alliarius (Miller)
,, *lucidus* (Draparnaud)
Vitrea (*Crystallus*) *crystallina* (Müller)
,, ,, *contracta* (Westerlund)
Zonitoides nitidus (Müller)
Discus rotundatus (Müller)
Theba pisana (Müller)
Helicodonta obvoluta (Müller)
Trichia sp.
Hygromia cinctella (Draparnaud)
Monacha cartusiana (Müller)
,, *cemeleana* (Risso)
Helicella (*Candidula*) *gigaxii* (L. Pfeiffer)
,, ,, *rugosiuscula* (Michaud)
,, (*Xerotricha*) *conspurcata* (Draparnaud)
,, (*Helicella*) *apicina* (Lamarck)
,, (*Xerocincta*) *neglecta* (Draparnaud)
,, (*Xeromagna*) *cespitum* (Draparnaud)
,, (*Cernuella*) *virgata* (da Costa)
,, (*Trochoidea*) *pyramidata* (Draparnaud)
,, ,, *crenulata* (Müller)
,, ,, *scitula* (Christofori & Jan)
Cochlicella ventricosa (Draparnaud)
Caecilioides acicula (Müller)
Clausilia (*Clausilia*) *crenulata* Risso
,, (*Papillifera*) *solida* Draparnaud
Vallonia pulchella (Müller)
,, *excentrica* Sterki
Abida polyodon (Draparnaud)
Chondrina avenacea jumillensis Guirao
,, (*Solatopupa*) *similis* (Bruguière)
Pagodulina pagodula (des Moulins)
Pupilla muscorum (L.)
Lauria cylindracea (da Costa)
Aghardia biplicata (Michaud)
Vertigo pygmaea (Draparnaud)
Truncatellina cylindrica (Férussac)
Cochlicopa lubrica (Müller)
Succinea elegans (Risso)
Lymnaea (*Radix*) *auricularia* (L.)
,, (*Galba*) *truncatula* (Müller)
Physa sp.
Planorbis (*Gyraulus*) *albus* (Müller)
Segmentina (*Hippeutis*) *complanata* (L.)
Carychium minimum Müller (aggr.)
Phytia myosotis (Draparnaud)
Acme (*Pupula*) *lineata* (Draparnaud)
Pleuracme (*Renea*) *moutoni* (Dupuy)
Bithynia tentaculata (L.)
Hydrobia acuta (Draparnaud)
Potamopyrgus jenkinsi (Smith)
Belgrandia gibba (Draparnaud)
? *Paladilhia* sp. (a damaged specimen, probably *P. pleurotoma* Bourguignat)
Truncatella subcylindrica (L.)
Valvata piscinalis (Müller)
Pisidium casertanum (Poli)
,, *personatum* Malm
,, *subtruncatum* Malm

My thanks are due to M. G. Ranson, of the Paris Natural History Museum, for his help and advice, and to Mr. A. E. Ellis for identifying the *Pisidium*.

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ANODONTA MINIMA MILLET IN THE CORFE RIVER, DORSET.

By A. G. DAVIS.

(*Read before the Society*, 21 *May* 1955.)

THE winter floods of 1954–5 scoured the bed of the little River Corfe and deposited refuse high above its banks. An examination of this refuse, in April 1955, showed that the molluscan fauna of the area consisted mainly of common species calling for no special note, except for the fact that it included *Anodonta minima*, hitherto not recorded for Dorset. The River Corfe rises in the Purbeck hills and above Corfe runs seaward to Arne near Poole, much of this being tidal. There is no connection with a river or source from which this species may have migrated. The area examined was that part of the stream which forms the moat at the foot of Corfe Castle, but the time at the writer's disposal did not permit an exhaustive search here or in other parts of the stream.

Six dead united valves were found on a low bank and only a few inches from the water, they had been dead for some time, were full of sediment and contained no trace of the animals. The interiors of the valves showed ferric stains deposited by the water.

The bottom of the stream had been scoured so clean that efforts to secure living examples were fruitless. The nearest stations known for the species are the Thames drainage and the river Wye. A voucher specimen has been deposited with the Society's collection at the British Museum (Natural History).

The following were found in the flood refuse : Terrestrial : *Pomatias elegans*, *Carychium minimum*, *Cochlicopa lubrica*, *Vertigo pygmaea*, *Pupilla muscorum*, *Vallonia costata*, *V. excentrica*, *Ena obscura*, *Clausilia bidentata*, *Helix hortensis*, *H. aspersa*, *Hygromia hispida*, *Helicella virgata*, *Discus rotundatus*, *Vitrea crystallina*, *Oxychilus draparnaudi*, *Retinella radiatula*. Aquatic : *Valvata piscinalis*, *Potamopyrgus jenkinsi*, *Bithynia tentaculata*, *Lymnaea peregra*, *L. truncatula*, *L. palustris*, *Ancylus fluviatilis*, *Anodonta anatina* (fragment), *Sphaerium corneum*, *Pisidium amnicum*, *Pisidium* spp. All the above were represented by small numbers (ones and twos), except *P. jenkinsi* and *S. corneum*, which were present in hundreds.

HYGROMIA (*PONENTINA*) *SUBVIRESCENS* (BELLAMY) IN CORNISH HOLOCENE DEPOSITS.

By A. G. Davis.

(*Read before the Society*, 19 *November* 1955).

Over half a century ago this southern snail was discovered in an Early Bronze age burial site at Harlyn Bay, near Padstow (R. A. Bullen, *Proc. Malac. Soc.* **5**, 185). At that time specialists agreed that the shells were *Hygromia montivaga* (Westerlund), but Kennard (*Proc. Malac. Soc.* **15**, 247) suggested that they may be *H. subvirescens* (Bellamy). Ellis (1926, *British Snails*, 212) recorded *H. subvirescens* from a Holocene deposit at Whitesand Bay, 2 miles north of Land's End, while the same author refers *H. montivaga* from Harlyn Bay to Bellamy's species (*J. Conchol.* **23**, 191). According to Kennard's MS. notes, the Whitesand Bay specimens were collected by Mr. A. W. Stelfox. The discovery this year of further examples in the Quaternary deposits of Cornwall is worthy of record. The blown sands and earlier deposits at Trebetherick Point, near Newquay, have long been known and have been studied by A. S. Kennard and S. H. Warren (*Geol. Mag.* N.S., (4), **10**, 19), B. B. Woodward (*Geol. Mag.* N.S., (5), **5**, 10) and more recently by W. J. Arkell (*Proc. Geol. Assoc.* **54**, 149). Extensive faunal lists were given by Kennard and Woodward, but *H. subvirescens* is absent from them. My friends Mr. and Mrs. J. N. Carreck have recently re-surveyed many of the Cornish Holocene deposits, and the writer is indebted to them for many samples collected during this work. At Trebetherick Point three samples taken at Point D of Arkell yielded twelve examples of *H. subvirescens*. Their distribution is as follows.

Sample (*a*). A 6-inch shelly layer below blown sand and ancient soil overlying the Head. Six examples.

Sample (*b*). Basal 1¼ foot of blown sands. Four examples, two of which are over normal size.

Sample (*c*). A little above the latter, two small examples. The land shells accompanying this species indicate grassy slopes facing the sea, the commonest species being *Pomatias elegans*, *Pupilla muscorum*, *Cochlicella acuta* and *Vallonia excentrica*.

The age of the blown sand is regarded as Bronze, while the basal part of it is probably Mesolithic. Sample (*a*) is probably older but is still Holocene.

Bullen records that he found some of his specimens in an undisturbed layer below the burials at Harlyn Bay, and the fauna recorded as accompanying them suggests an equivalence in age and conditions with samples (*a*) or (*b*) from Trebetherick Point.

HYGROMIA (*PONENTINA*) *SUBVIRESCENS* (BELLAMY) IN SOUTH DEVON.

By A. G. Davis.

(*Read before the Society*, 19 *November* 1955.)

Between Beer Head and Branscombe there are heavy falls of chalk from the top of the cliffs. Many of the fallen blocks come to rest at beach level, still retaining their cappings of humus and vegetation. Some of the blocks are noticeable for their thick mats of ivy, and on lifting the mats to see what may be lurking beneath them a black powdery humic soil with a plentiful supply of dead and living land shells was found. A sample of this black powder and debris was taken and later examined. It yielded *Abida secale* (3 alive), *Lauria cylindracea* (very abundant), *Cochlicopa lubrica* (one alive), and a single dead shell of *Hygromia subvirescens.*

This note is offered with the hope that other observers will make a more thorough search than the writer was able to undertake. The site was about half way between Branscombe and the headland of Beer, and the top of the cliff may offer a better reward than the fallen blocks and thus establish the presence of a living colony. The species is here at the eastern limit of its range in England, the nearest record being Axminster, with the single qualification that it was found on the chalk (Parfitt, E., 1874, The Fauna of Devon. *Trans. Devons. Assoc.* **6**, 636). The distance from the sea seems unusual for this coastal species but there seems no reason to doubt the record. Its presence on the chalk is supported by the Branscombe find. *H. subvirescens* is distributed along the coast of South Devon from Plymouth to Dawlish.

***Lymnaea stagnalis* (L.) in Anglesey.**—Boycott (*J. Animal Ecol.* **5**, 156, 1936) states that " L. Maelog and L. Coron (both in Anglesey) are the most westerly loci for *Limnaea stagnalis*, and they are about 60 miles to the north and west of its nearest known habitat ". Therefore I was much interested when Dr. H. B. N. Hynes told me that in June 1953 he had taken *L. stagnalis* in Llyn Llywenan, near Bodedern, on the western side of the island, 5 miles north of Llyn Maelog. The Mollusca found in it were *L. stagnalis*, *L. palustris*, *Physa fontinalis*, *Planorbis contortus*, *P. albus* and *Sphaerium corneum.* It also held eels, trout and 2 species of stickleback. Dr. Hynes kindly gave me details of his analysis of the lake-water : the total hardness (as calcium) was 31 milligrammes per litre.

N. F. McMillan.

ENA MONTANA (DRAPARNAUD) IN HERTFORDSHIRE.

By L. Lloyd-Evans, M.B., Ch.B.

(*Read before the Society*, 19 *November* 1955.)

Ena montana is included in the list of Mollusca of Hertfordshire in the *Victoria County History* (1902), and dead shells have been recorded from Aldbury (*Trans. Herts. Nat. Hist. Soc.* **15**, 20, 1913), but there seems to be no definite record of the species still living in the county.

On 26 October 1955, a mild day with light rain, two living specimens and three dead shells of *Ena montana* were found in the parish of Little Munden, on the hedge-bank of a sunken farm lane leading from Green End down to the Old Bourne (Nat. Grid 52/323225). The lane passes between Banfield Wood and Grave's Wood, and the snails were found on a restricted area of the left, north facing bank, about thirty yards below the lower edge of Grave's Wood, which lies on the 300 feet contour line.

The snails were on moss covering loose stony soil, under rather luxuriant vegetation dominated by nettles (*Urtica dioica*) and hogweed (*Heracleum sphondylium*), with *Anthriscus sylvestris* and *Vicia sepium.* Nearby plants typical of calcareous soils were *Galium mollugo*, *Clinopodium vulgare* and *Centaurea nigra* ssp. *nemoralis.* On top of the bank was a heavily pollarded maple (*Acer campestre*) ; widely spaced along the bank were bushes of dogwood (*Cornus sanguinea*) and hazel (*Corylus avellana*). About ten yards above the site was a patch of bracken (*Pteridium aquilinum*). On the other side of the hedge was a field of corn-stubble, cultivated right up to the bank and at that point lying about three feet above the level of the lane. Banfield Wood and Grave's Wood lie on downwash from glacial gravel capping the hill at Green End, and are of standard oaks (*Quercus robur*), with coppiced hornbeam (*Carpinus betulus*) and a ground layer of *Mercurialis perennis.* The lower edge of Banfield Wood falls away steeply exposing chalk, which underlies the lower part of the valley and the site where *Ena montana* was found.

The commonest associated Mollusca were *Hygromia striolata* and *Azeca goodalli*, with lesser numbers of *Monacha cantiana*, *Oxychilus cellarius* and *Clausilia bidentata.* A few dead shells of *Helix pomatia* and *Pomatias elegans* were scattered along the hedge-bank, and were more numerous under the exposed chalk at the lower edge of Banfield Wood, where one living specimen of *P. elegans* was found.

On the 1840 Tithe Award map of the parish the relevant features are the same as at present.

RAISED BEACH SECTION AT GROOMSPORT, CO. DOWN.

By R. MacDonald and J. G. MacWilliams.

(*Read before the Society*, 15 *October* 1955.)

A Short time ago, while walking down the road at the Point Groomsport, we noticed an excavation in connection with a new sewerage scheme. The excavation, which took the form of a large square hole, appeared to be about 15 or more feet in depth, but the bottom could not be seen owing to the presence of water. The sides of the excavation showed the following sequence of strata from above downwards.

E. Disturbed surface soil 11 ins. The top of this layer was at 17 ft. 3 ins. O.D.
D. Fine gravel with shells, 11 ins. *Aporrhais pespelicani quadrifidus* da Costa occurred only in this layer.
C. Medium stones and gravel with shells, 13 ins.
B. Boulders with sandy clay. Shells absent, 20 ins.
A. Red clay. Top at 12 ft. 9 ins. O.D.

The fauna was generally distributed throughout layers D and C, being the same in each, with the exception of one species noted above. All the Mollusca species, except *A. pespelicani quadrifidus*, occur in the area at the present time.

FAUNA.

Protozoa : Foraminifera.
Polystomella sp.

Crustacea : Cirripedia.
Balanus balanoides L. Valves, scuta and terga.

Echinodermata : Echinoidea.
Echinus spines.

Mollusca : Pelecypoda.
Cardium edule L.
Pecten fragments.
Paphia pullastra (Montagu).

Mollusca : Gastropoda.
Patella vulgata L.
Littorina littoralis (L.).
L. littorea (L.).
Cingula semicostata (Montagu).
Bittium reticulatum (da Costa).
Aporrhais pespelicani quadrifidus da Costa.
Nucella lapillus (L.).
Nassarius reticulatus (L.).

The section, which is now built over, was visited by us in company with Mr. V. B. Proudfoot, shortly after its discovery, when he took samples for archaeological examination. Reference to two other raised beach sections in this area, now also no longer visible, will be found in a paper by R. Ll. Praeger (*Proc. Roy. Irish Acad.* 3rd ser., **2**, 33, 1897). They were at Ballyholme and Orlock respectively. The Ballyholme section was destroyed many years ago when the new sea-wall was built, while that at Orlock persisted until 1935, when it too was built over.

In conclusion we wish to record our thanks to Mr. Proudfoot for supplying us with data relative to levels.

***Acroloxus lacustris* (L.) in Merionethshire.**—On 18 July 1955, two specimens of *Acroloxus lacustris* were collected in Llyn y Gafr, a small lake at about 1350 feet on the northern face of Cader Idris (Nat. Grid 23/710141). They were attached to stones near the northern shore, together with small specimens of *Lymnaea peregra*. Above the lake are cliffs of basic Ordovician rock on which grow such typical calciphiles as *Asplenium viride*, *Arabis hirsuta* and *Saxifraga oppositifolia*. Llyn y Gafr contains no *Isoetes lacustris*, a plant which prefers water poor in dissolved salts. Llyn y Gader, a similar lake on acid rocks higher up (1800 ft.) does contain *Isoetes*, and no snails were found in it.

L. LLOYD-EVANS.

(*Read before the Society*, 19 *November*, 1955.)

REVIEW

Sites of Infection. Unstable Areas as Sources of Parasitic Diseases: Schistosomiasis and Fascioliasis. ALAN MOZLEY, D.Sc., Ph.D., F.R.S.E. Pp. x, 86; 14 text figures from photographs. London. H. K. Lewis and Co., Ltd. 1955. 9*s*.

IN this work Dr. Mozley develops and amplifies his previous work, reviewed in this *Journal*, volume 24, p. 25, 1954, on the factors concerned in the production of sites that are favourable for the multiplication of snails that transmit human and animal diseases.

The photographs give a good idea of the characteristics of "safe" and "dangerous" sites. Short term and long term methods that can be employed to transform dangerous sites are described, and it is emphasized that treatment of individual human and animal patients, though necessary from a humanitarian point of view, will never eliminate these diseases. Elimination depends on the combined efforts of biologists, sanitary officials and governments.

The discussion of the formation and development of "unstable sites" is of value not only to the physician and parasitologist, but also to the conchologist and field naturalist.

An appendix gives the life cycle of the Bilharzia parasites and of the Liver-fluke parasite, and another gives some general principles of ecology with definitions of various terms.

H. E. QUICK.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND

738th Meeting, held at the British Museum (Natural History), 19 March 1955.

The President in the chair.

Members Elected.

Michael Marchmont Anderson, B.Sc. (Wales), F.G.S., F.L.S., c/o University College of the Gold Coast, Achimota, Gold Coast.

Hugh Douglas Swan, M.P.S., 48 Loose Road, Maidstone, Kent.

Cecil Barrington Thompson, 504 Raleigh House, Dolphin Square, Westminster, London, S.W. 1.

Communications.

" Roebuck's papers on Scottish non-marine Mollusca," by W. Russell Hunter and Myra Russell Hunter.

" Notes on four Quaternary deposits in the Cambridge region," by B. W. Sparks.

" On the former occurrence of *Vertigo parcedentata* (Al. Braun) in Hertfordshire," by M. P. Kerney.

" Snails preyed upon by Jays and Magpies " ; " *Helix nemoralis* in a calcium deficient habitat " ; " *Dreissena polymorpha* in a closed pond " ; " *Lauria anglica* at Meathop Fell, Westmorland " ; by G. W. Pitchford.

Exhibits.

Special exhibits : *Sepia*, *Acavus*.

The President : shells of the British species of *Sepia*.

Mr. G. A. S. Barnacle : *Acavus* from Ceylon.

Rev. H. E. J. Biggs : *Hygromia cinctella*, Ilsham Valley, Torquay, S. Devon, and Italian examples for comparison : *Spondylus gloriandus* bored by *Lithodomus*, Persian Gulf.

Mr. D. Curry : *Sepia orbignyana* shells, N. E. Spain ; *Belosepia*, Middle Eocene, Bracklesham and Paris basin.

Lt. Col. R. J. Griffiths : abnormal *Cypraea lamarckii* with under-developed shell ; *C. mauritiana* with damaged shell partly restored during life ; both from East Africa.

Mr. M. P. Kerney : specimens to illustrate his paper.

739th Meeting, held at the British Museum (Natural History), 16 April 1955.

The President in the chair.

Communication.

" *Cypraea* in north-west Malaya," by Lieut. Colonel R. J. Griffiths.

Exhibits.

Special exhibits : Bullariidae and Corbiculidae.

The President : British *Sphaerium* and *Pisidium.*

Mr. C. P. Castell : fossil Bullariidae and Corbiculidae from the British Museum collections.

Lt.Col. R. J. Griffiths : specimens, photographs and map to illustrate his paper.

Mr. G. L. Wilkins : photographs of *Akera bullata*, showing swimming action, from a paper by J. E. Morton and N. A. Holme in *J. Marine Biol. Assoc.* **34**, pl. 1, and the plate illustrating this species in Meyer and Möbius, *Fauna der Keiler Bucht.* (Note : a paper by Morton on the functional physiology of *Otina otis* appears in the same number of *J. Mar. Biol. Assoc.*, pp. 113–150).

740th Meeting held at the British Museum (Natural History), 21 May 1955.

The President in the chair.

Communications.

" *Anodonta minima* Millet in the Corfe River, Corfe, Dorset," by A. G. Davis.

" The generic names *Pomacea* and *Ampullarius*, " by T. Pain.

" Extracts from a notebook of George Montagu, 1796–98, " by H. E. Quick.

Exhibits.

Special exhibits : Lucinidae, Endodontidae.

The President : *Lucina* from British Isles, Australia and New Zealand.

Mr. C. P. Castell : Recent and fossil Endodontidae and fossil Lucinidae from the British Museum collections.

Mr. T. E. Crowley : shells from river Colne, Denham, Bucks.

Mr. A. G. Davis : specimens to illustrate his paper.

Lt. Col. R. J. Griffiths : cowries from Cadiz, Spain.

Mr. M. P. Kerney : *Discus ruderatus*, Pleistocene, Barnfield Pit, Swanscombe, and Holocene, Wilstone, Herts ; *Retinella petronella*, Holocene, Wilstone.

Mr. T. Pain : Oriental *Ampullaria.*

Mr. G. W. Pitchford : living *Helix pomatia* of different ages bred in captivity ; varieties of *Helix nemoralis*, Southwell, Notts.

Dr. H. E. Quick : MS. notebook of Montagu ; living *Pomacea canaliculata australis* from the Zoological Gardens, with water-colours of adult and young.

Mr. G. L. Wilkins : Lucinidae from the Winckworth collection.

741st Meeting, held at the British Museum (Natural History), 15 October 1955.

The President in the chair.

Member Deceased.

The President announced the death, on 29 September, of Lieut. Colonel Cyril J. F. Bensley.

Communications.

" A tidal flat on the Vermilion Sea," by S. Stillman Berry.

" Mollusca on Scottish Mountains," by W. and Myra Russell Hunter.

" A new species of *Corilla* from Ceylon," by G. A. S. Barnacle.

" A raised beach section at Groomsport, Co. Down," by R. MacDonald and J. G. MacWilliams.

" A new Sussex locality for *Pisidium pseudosphaerium* Favre," and " Eggs of *Discus ruderatus* (Férussac) from the Pleistocene," by S. P. Dance.

Exhibits.

Special exhibits : Epitoniidae and Aetheriidae.

The President : Epitoniidae from New Zealand ; shell of *Clausilia bidentata* with two mouths, from Malham, Yorkshire. Also a living *Arianta arbustorum*, taken at Durness, Sutherland, by A. W. Stelfox, July 1954, and kept isolated ever since ; in July 1955 it laid eggs which hatched and the young are thriving.

Mr. G. A. S. Barnacle : specimens to illustrate his paper.

Mr. C. P. Castell : Fossil Epitoniidae and Aetheriidae from the British Museum collections.

Mr. S. P. Dance : *Albinaria* from the eastern Mediterranean region ; *Theba pisana* from South Wales and Cyprus ; *Eremina desertorum* from the Suez Canal zone ; recent and fossil *Pisidium.*

Mr. G. W. Pitchford : mutants of *Helix nemoralis* bred by A. W. Stelfox.

Mr. G. L. Wilkins : *Aetheria* from the British Museum collections.

742nd Meeting, held at the British Museum (Natural History), 19 November 1955.

The President in the chair.

Member Elected.

John Q. Burch, 1584 West Vernon Avenue, Los Angeles 62, California, U.S.A.

Communications.

" A new land shell from Colombia," by T. E. Crowley.

" *Hygromia subvirescens* (Bellamy) in Cornish Holocene deposits," and " *Hygromia subvirescens* in South Devon," by A. G. Davis.

" A preliminary note on the nature of certain granules from post-Glacial deposits in the Lea valley," by Dr. J. F. Hayward.

" Further notes on the non-marine Mollusca from semi-arid areas of East Africa," by T. Pain.

" A new subspecies of *Pila africana* (Martens)," by L. A. W. C. Venmans.

" Mollusca in the alluvia of the river Siagne," by Dr. A. Comfort.

"Effects of a gale on the South Lancashire coast," by the Rev. Prof. L. W. Grensted, D.D.

"Two forms of *Lymnaea auricularia* (L.) in one pond," and "*Lymnaea stagnalis* (L.) in Anglesey," by Mrs. N. F. McMillan.

"*Ena montana* in Hertfordshire," and "*Acroloxus lacustris* in Merionethshire," by Dr. L. Lloyd-Evans.

"A new locality for *Cypraea guttata* Gmelin," by Prof. Masao Azuma.

Exhibits.

Special exhibits: Mactridae and Thiaridae.

The President: Mactridae from England, Australia and New Zealand; living *Ena montana* collected by Dr. L. Lloyd-Evans in Hertfordshire.

Rev. H. E. J. Biggs: Persian *Melanopsis.*

Mr. C. P. Castell: Fossil Thiaridae from the British Museum collections.

Dr. A. Comfort: land shells from the Caucasus and specimens and photographs to illustrate his paper.

Mr. A. G. Davis: Shells from blown sands, Cornwall; specimens to illustrate his papers.

Lt. Col. R. J. Griffiths: *Cypraea dillwyni*, Mauke, Cook Islands; *C. vredenburgi*, South Java; *C. pallidula*, N.E. Queensland; *C. kieneri depriesteri* (syntype), S. Java.

Mr. T. Pain: typical examples of the genera and subgenera of Thiaridae.

Mr. G. W. Pitchford: *Arianta arbustorum*, *Helix nemoralis* and *H. aspersa* from a tufa deposit, Southwell, Nottinghamshire.

Mr. G. L. Wilkins: Mactridae from the Winckworth collection.

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CONTENTS.

PAGE

List of Officers and Council 109

Anodonta minima Millet in Dorset—A. G. DAVIS . . . 110

The Mollusca of the Malham area—L. W. STRATTON . . 111

Sinistral *Oxychilus cellarius* (Müller) in Sweden—H. SCHLESCH 138

A preliminary note on the nature of certain granules from Post-Glacial deposits in the Lea Valley—J. F. HAYWARD . 139

A new subspecies of *Pila africana* (Martens)—L. A. W. C. VENMANS 140

Further notes on the non-marine Mollusca from semi-arid areas of East Africa—T. PAIN 142

A new species of *Synapterpes* from Colombia—T. E. CROWLEY 144

Effects of a gale on the South Lancashire coast—L. W. GRENSTED 145

A new locality for *Cypraea* (*Erosaria*) *guttata* Gmelin—MASAO AZUMA 146

Pisidium obtusale lapponicum Clessin from the Lower Gravel at Swanscombe, Kent—S. P. DANCE 147

Review: Abbot, *Introducing Sea Shells*—G. L. WILKINS . 148

Proceedings: 17 Dec., 1955; 21 Jan., 18 Feb. (Annual Meeting), 17 March, 21 April, 1956 148

Accounts for 1955 153

PLATES 5 & 6

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ANODONTA MINIMA MILLET IN DORSET

By A. G. Davis

(*Read before the Society*, 21 *January* 1956)

Dredging operations in the River Stour at a point opposite Canford School during the last two months presented an opportunity of examining the fauna brought up from the river bed. My brother, Mr. N. F. Davis, noticed that the deposits contained mussels and kindly sent me a quantity of specimens, together with samples of the bottom material. *Anodonta minima* was quite common but all were dead shells, filled with deposit, but with the periostracum and ligament well preserved. My brother and I have searched the river at various times from Corfe Mullen to Christchurch, and the only mussel we have found is the small Hampshire and Wiltshire form of *Anodonta anatina*. The bottom deposits brought up by the dredger showed an abundance of shells. My list includes 30 freshwater and 20 land species, representing a fauna brought from a variety of loci and clearly of various ages.

At Little Canford, about a mile down stream, the river forms a horseshoe bend and the south bank is a river cliff in which alluvial deposits are seen in situ. The lowest two feet at water level is a black silt packed with shells; 30 species are present but no mussels. Above this is yellowish sandy stony bed 3 to 4 feet thick, with shells in less profusion but with a similar number of species, including some which do not occur in the lower bed. Among them is *Anodonta minima*, represented by 3 or 4 single valves. They are devoid of periostracum and in a mineral condition reminiscent of the shells from the alluvium of Penton Hook, Middlesex. The cliff is still being eroded by the river and quantities of Holocene shells are washed into its bottom deposits.

Further upstream at Corfe Mullen are alluvial shelly deposits, but I could find no trace of *A. minima*. At Christchurch, at the mouth of the river, extensive deposits were exposed in excavations at the Hampshire Waterworks. Shells were abundant, 30 species, but no trace of mussels.

Whether *A. minima* is still living in the Stour is yet to be proved. We have proof at Little Canford that it was there at an earlier period than the present, probably Roman to Medieval times. The condition of the shells from the Canford dredgings suggests that they have not long been dead. A search of the river has failed to yield living specimens. Previous workers have never recorded this shell from the area. The condition of the Canford shells may be the result of entombment in an impervious layer or being sealed by such a layer. The presence of colour or periostracum has often been put forward as indicating lack of antiquity, but an abundance of *Pisidium* with periostracum preserved has just been discovered elsewhere in a sealed deposit of undoubted Pleistocene age.

THE MOLLUSCA OF THE MALHAM AREA

By L. W. STRATTON

(*Presidential Address, delivered* 18 *February* 1956)

IT is now nearly seventy years since the first list of Mollusca for the Malham area was published (Soppitt & Carter, 1888). Since that time many lists and notes have appeared in various publications, and some 64 species of land and freshwater Mollusca recorded. As some intensive work has recently been done on this group, it seems an appropriate time to bring together all the published material on this very interesting area so that it is readily available; and to add some discussion on the relationships of the Mollusca with one another and with their environment.

The area over which the recent studies were undertaken (Fig. 1) is some 6 miles from north to south and 2½ miles from east to west, extending from the southern slopes of Fountains Fell in the north to Malham village in the south and embracing the valleys of Malham Beck and Gordale Beck. It also includes particularly interesting features in Malham Tarn, Malham Cove and Gordale.

In order to appreciate either flora or fauna, some knowledge of the geology of the neighbourhood is necessary (Fig. 2). While its basic geology is fairly well defined, the surface features are more complicated, and only a simplified pattern of these can be given here. Malham is in the middle of the Craven Country, and its geology is dominated by the Craven fault system. Only the North and Middle Craven Faults need to be considered. The North Craven Fault, running from west to east, does not now contribute appreciably to the landscape, though, as will be shown later, it is at least partly responsible for the existence of Malham Tarn. The Middle Craven Fault, again running from west to east, is much more clearly defined, although the steep escarpment has, owing to denudation, retreated in some places from the actual line of the Fault.

These two faults divide the area roughly into three parts, each having its distinctive features. To the north lies the country of the high fells, with " peaks " such as Fountains Fell and Penyghent, of Yordale Limestones, shales and sandstones, with cappings of Millstone Grit. Only the lower slopes of Fountains Fell come within the scope of this paper, and here may be found areas of acid drift, limestone outcrops and small damp areas growing nettles. Between the fells and the Middle Craven Fault lies a plateau consisting of the very pure Great Scar limestone. This is the country of the " scars " or cliffs of limestone, limestone outcrops and pavements and deep gorges. There are also substantial areas of drift, both calcareous from the limestone and acid from the grits and shales, all very much mixed up. Some of this is grassland, some marsh. Along the line of the North Craven Fault there are also small outcrops of the older Silurian rocks, which generally deeply underlie the whole area. South of the Middle Craven Fault, some 300 feet lower, is a more rounded, down-like country with areas of acid shale. Where, however, the limestone is at the surface, " springs " appear, full-fledged streams which have gone underground on the plateau above.

As the substratum throughout the greater part of the area is limestone, much of the soil is base-rich. The scars, walls, pavements, screes and some of the pastures are highly calcareous. Of the wet areas, marshes, flushes, springs, etc., some are of calcareous clay or mud; others of organic origin such as peat, may have lime in solution. Except for some local tracts of blanket bog, as, for example, on Fountains Fell and around the Smelt Mill, and the peat of the Tarn Moss, very little of the soil is base-deficient, only a few small areas of acid drift, while most grassland and woodland soils are intermediate, as are some of the marshes and the fen-bog transition. In actual fact there are other complications, but in the main this gives a fair pattern of the soil values. In so far as this affects the Mollusca, some of the obligatory calcicoles are absent, but so is our only obligatory calcifuge. There are many calcicole species, but also many indifferent to lime. There is in the area quite an unexpected diversity of habitats for Mollusca, and, apart from the presence or absence of lime, it is possible to study the full range, from those frequenting dry places to those entirely aquatic. An important feature of the landscape is the many miles of stone walls. These are nearly all of limestone, with the result that calcicole species of snails will turn up in quite unexpected places.

The following is a list of the species recorded up to and including 1955, the dates being those of the earliest published records. Those without dates were first found in the area in 1955; the records, therefore, have not yet been published.

Valvata cristata (Müller)	1947
V. piscinalis (Müller)	1883
Potamopyrgus jenkinsi (Smith)	1950
Bithynia tentaculata (L.)	1887
Carychium minimum Müller	1910
C. tridentatum (Risso)	
Lymnaea truncatula (Müller)	1883
L. palustris (Müller)	1910
L. stagnalis (L.)	1883
L. peregra (Müller)	1890
Physa fontinalis (L.)	1891
Planorbis leucostoma Millet	1890
P. albus Müller	1891
P. crista (L.)	1883
P. contortus (L.)	1888
Ancylus fluviatilis Müller	1888
Succinea putris (L.)	1883
S. pfeifferi Rossmässler	1890
Azeca goodalli (Férussac)	1890
Cochlicopa lubrica (Müller)	1882
C. lubricella (Stabile)	
Pyramidula rupestris (Draparnaud)	1877
Columella edentula (Draparnaud)	
Vertigo pusilla Müller	1882
V. antivertigo (Draparnaud)	1948
V. substriata (Jeffreys)	
V. pygmaea (Draparnaud)	1882
Pupilla muscorum (L.)	1882
Lauria cylindracea (da Costa)	1877
Abida secale (Draparnaud)	1871
Acanthinula aculeata (Müller)	
Helix hortensis Müller	1888
H. nemoralis L.	1888
Hygromia striolata (C. Pfeiffer)	1887
H. hispida (L.)	1882
H. liberta (Westerlund)	
Monacha granulata (Alder)	1883
Helicella itala (L.)	1873
Punctum pygmaeum (Draparnaud)	1887
Discus rotundatus (Müller)	1887
Arion intermedius Normand	1910
A. circumscriptus Johnston	1891
A. hortensis Férussac	1910
A. subfuscus (Draparnaud)	1910
A. ater (L.)	1890
Euconulus fulvus (Müller)	1887
Vitrea crystallina (Müller)	1890
Oxychilus cellarius (Müller)	1888
O. alliarius (Miller)	1890
O. helveticus (Blum)	1890
Retinella radiatula (Alder)	1890
R. pura (Alder)	1883
R. nitidula (Draparnaud)	1891
Vitrina pellucida (Müller)	1877
Limax maximus (L.)	1925
L. marginatus (Müller)	1877
Agriolimax reticulatus (Müller)	1890
A. laevis (Müller)	1883
Sphaerium corneum (L.)	1883
Pisidium amnicum (Müller)	1888
P. casertanum (Poli)	1888
P. personatum Malm	

Vallonia pulchella (Müller)	1891
Ena obscura (Müller)	1883
Clausilia bidentata (Ström)	1883
C. dubia Draparnaud	1882
Balea perversa (L.)	1882
Cecilioides acicula (Müller)	
Helicigona lapicida (L.)	1877
Arianta arbustorum (L.)	1877
P. obtusale (Lamarck)	
P. milium Held	1929
P. subtruncatum Malm	1929
P. lilljeborgi Clessin	1929
P. hibernicum Westerlund	1936
P. nitidum Jenyns	1883
P. pulchellum Jenyns	

Helix aspersa Müller has been recorded for Airton, just south of the area, and Soppitt and Carter (1888) record *Zonitoides excavatus* (Alder) and *Helicella caperata* (Montagu) for " Fagley Wood, near Malham Tarn ". Diligent map searching and enquiry at Malham have failed to locate Fagley Wood, which may have been cut down. These three species have not been included in the list.

Of the 77 species in the list, only six were not found in 1955, *Valvata cristata* (though it was found in 1954), *Planorbis crista*, *Vertigo pusilla*, *Abida secale*, *Helicigona lapicida* and *Helicella itala*. Considering that there was but one slight shower during the whole fortnight, this may be considered as something of an achievement. Of the 71 species found, seven were new vice-county records, comprising the confirmation of three segregate records previously given as aggregates—*Carychium minimum*, *Arion ater* and *Vallonia pulchella*; two recently separated as species, *Cochlicopa lubricella* and *Hygromia liberta*; and two entirely new, *Carychium tridentatum* and *Pisidium pulchellum*. There were in all thirteen species new to the Malham area.

One rather surprising thing is that, of the genus *Helicella*, only *H. itala* has so far been found in the area, although there appear to be plenty of suitable habitats. *Pomatias elegans* is also missing, possibly due to the lack of hedgerows and woods of the right kind. One of the difficulties of comparing present findings with the older records is that the latter are in the main mere lists, with exact loci given all too seldom, while ecological notes of any kind are almost entirely lacking.

It is proposed to deal first with the various kinds of habitats and their molluscan fauna, and add some notes on interesting species.

Land Habitats

In considering the association of land snails one with another, it must be remembered that there is no reason to suppose that any one species has any predilection for the company of any other species. Certain species have a preference for certain kinds of habitats and are therefore often found together, while others which seem more adaptable are found in many kinds of habitats. In surveying the land snails in the Malham area in 1955, over 70 loci were investigated; *Hygromia striolata*, *Discus rotundatus* and *Vitrea crystallina* were found in over 30 of them, and, under better collecting conditions, would probably have been found in more. On the other hand, *Punctum pygmaeum*, *Limax maximus* and *Limax marginatus* were found only in one each. The first was probably missed in some other loci owing to its small size, and the conditions were the worst possible for slugs.

In considering the habitats, the dominant factors to be taken into account are those of calcium carbonate, moisture and shelter. Much of the area is highly calcareous, most of it more or less so; the average rainfall at Malham is 60 inches per annum; the shelter, as elsewhere, is variable.

Since the scars are the dominating features of the landscape, these may be taken first. In many cases there is a scree slope below each cliff face, though the amount of scree is very variable. At Highfolds Scar only about a third of the cliff face shows above the scree, while in other places there is very little scree, and in one or two the cliff comes right down to the valley floor. Often the upper part of the scree is grass-grown, the loose debris being further down the slope; sometimes vice versa. In some cases the loose material is in much larger pieces than in others. The scar faces are fissured by long, vertical cracks of varying width and depth, and there are innumerable little shelves on which grass and other plants grow. The rock is the pure Great Scar limestone; the situation dry; the shelter provided only by the cracks and the plants on the shelves. The dominant species are *P. rupestris*, *C. bidentata*, *C. dubia* and *L. cylindracea*. The first three hide in the cracks; the last named lives on the shelves. The sifting of soil from them reveals hundreds of dead shells of *L. cylindracea* and many of the other species. When it is wet, or the humidity is sufficiently high, the snails come out to feed on lichens on the rock faces. *P. rupestris* and *C. dubia* seem quite indifferent to the weather, and some may always be seen on the rock faces, even after long spells of hot, dry weather. Less common species on the scars are *C. lubricella*, *E. obscura*, *H. striolata*, *D. rotundatus* and *V. crystallina*, and on the shelves of Highfolds Scar was found *C. acicula*, new to Malham. The loose screes are very dry; an odd snail or two may occur on the grass grown parts, but in the loose material no snails live, probably due to the extreme dryness and the lack of soil for egg laying. By contrast, just below the Gordale Scar waterfall, where there are but a few feet of grass grown scree at the foot of a 200 foot cliff, twenty species were found in the longer grass where scree and cliff face meet, including *A. arbustorum*, *H. nemoralis*, three species of *Oxychilus* and many others.

The higher parts of the plateau rise above the scars as hill-tops and there are large masses of exposed limestone, here and there pavements, with areas of grassland between. Typical examples of this are Broad Scars and Broad Flats, lying above the road from Malham village to the Tarn. Here again the four scar dominants are found, but not so freely; most of the others are also present and in addition *O. cellarius*, *O. alliarius* and *R. radiatula* appear, with here and there small colonies of *Helix hortensis*.

Pavements occur in many places, the best known being the one above Malham Cove. These pavements consist of roughly rectangular blocks of limestone, known as clints, with deep fissures, called grykes, between. The Malham Cove pavement, with a 300 foot cliff below it, has very deep grykes grown with trees and plants, which, owing to the attention of sheep, never grow above the level of the clints. There is abundant shelter and, in normal seasons, the depths of the grykes must be fairly damp. It is odd that there are no records of Mollusca from this pavement, and in 1955 only occasional shells of *H. hortensis* and *H. nemoralis* were found. Generally the other pavements, having no cliff to assist drainage, have the grykes much more choked with debris, and can yield a variety of species. Of two examined, one close to Middle House, the other at Green Hill Scar, the following species were found; *C. lubrica*, *C. lubricella*, *P. rupestris*, *L. cylindracea*, *E. obscura*, *A. arbustorum*, *H. nemoralis*, *H. hispida*, *D. rotundatus*, *E. fulvus*, *V. crystallina*, *O. cellarius*, *O. alliarius*, *R. radiatula*, *R. nitidula*, *V. pellucida* and *A. reticulatus*. For information on the formation of pavements see Moisley (1954).

Since walls form such a prominent feature in the Malham area, it is appropriate to consider them next. A description of the different types of walls has been given previously (Stratton, 1955). They traverse all kinds of country, and may be seen perched, seemingly precariously, on the tops of scars, or crossing marshes. Being of limestone, and in themselves generally dry, calcicole species such as *C. dubia* and *P. rupestris* may be found on them far from any limestone mass, their usual habitats. Moss grows at the base of some walls, others have only the local vegetation growing round the lower stones, and in this many of the common species are found, and, in one instance, in the middle of an area of drift, *C. tridentatum* and *V. pellucida* were found, far from any other of their known habitats. Walls also surround houses and gardens in Malham village, and here, we were told, *B. perversa* and *H. lapicida* occur in " great profusion ". The dry weather must account for the fact that, in 1955, patient search failed to reveal a single specimen of either.

Two particularly interesting places may well come in here, Malham Cove and the wood at Janet's Foss. Malham Cove, with its 300 feet cliff, screes and shelves, its stream issuing at the base of the cliff and its natural ash wood have already been described (Stratton, 1955). The wood at Janet's Foss lies below the Fall, between Gordale Beck and a long low scar. The wood, parts of which are natural, grows on the scree below the scar. Each has a great beauty of its own, and, while being in many ways so different, conchologically reminds one of the chalk pits of southern England. For purposes of comparison, the following table gives the Mollusca for Malham Cove, Janet's Foss Wood and two chalk pits in Aldenham in Hertfordshire, described by the author in 1950.

Laciniaria biplicata occurs in Moses Dell, but was introduced. *Helicigona lapicida* has been found at Blackbird's Wood, but only dead shells, possibly Holocene.

	Malham Cove	Janet's Foss	Moses Dell	Blackbird Wood
Azeca goodalli	X			
Balea perversa		X		
Monacha granulata		X		
Retinella radiatula	X			
Cochlicopa lubricella	X	X		
Pyramidula rupestris	X	X		
Lauria cylindracea	X	X		
Clausilia dubia	X	X		
Arion intermedius	X	X		
Cochlicopa lubrica	X	X	X	
Arianta arbustorum	X	X		X
Helix hortensis	X	X	X	
H. nemoralis	X	X		
Arion subfuscus	X	X	X	
Arion ater	X	X	X	
Euconulus fulvus		X		X
Ena obscura	X	X	X	X
Clausilia bidentata	X	X	X	X
Hygromia striolata	X	X	X	X
H. hispida	X	X	X	X
Discus rotundatus	X	X	X	X
Arion circumscriptus	X	X	X	X
Vitrea crystallina	X	X	X	X
Oxychilus cellarius	X	X	X	X
O. alliarius	X	X	X	X
O. helveticus	X	X	X	X
Retinella nitidula	X	X	X	X
Vitrina pellucida	X	X	X	X
Arion hortensis		X	X	X
Retinella pura	X		X	X
Agriolimax reticulatus	X		X	X
Carychium minimum agg.			X	X
Marpessa laminata			X	X
Monacha cantiana			X	X
Helicella caperata			X	X
Limax maximus			X	X
Pomatias elegans				X
Acanthinula aculeata				X
Punctum pygmaeum				X
Milax sowerbyi			X	

It will be seen from this that of 40 species, twelve occur in all four loci and nine in three, and any of these nine may yet be found in the other. The same applies to *E. fulvus*, found in one Malham and one Aldenham locus. Of the nine species recorded for Malham and not for the chalk pits, *C. dubia* is essentially a northern species (for its distribution see Blackburn, 1940). *P. rupestris* is unlikely to occur in Aldenham; there is but one doubtful record of it in Hertfordshire. Of the rest, all but *C. lubricella* have been found elsewhere in Aldenham. Nine species are recorded for Aldenham and not for the two Malham loci. Of these, *C. minimum*, *L. maximus*, *A. aculeata* and *P. pygmaeum* all occur at other places at Malham. One was surprised not to find *P. elegans* or *M. cantiana*, the situation in both loci being eminently suitable, as they are for *M. laminata*. Perhaps the isolation from similar habitats has prevented colonization. Both *H. caperata* and *M. sowerbyi* have only unconfirmed records for the vice-county 64.

The other woods in the area are all planted and of comparatively recent date. The largest is the one behind the Tarn House, and is on and below the screes of Highfolds Scar. The subsoil is calcareous but, particularly at the western end, the leaf mould is acid. Sixteen species occur in the wood, a fair number considering its age. It is only the other Malham locus for *O. helveticus*, which lives only in the more calcareous part with *H. nemoralis*, and in the area appears to be essentially woodland, probably owing to the lack of hedgerows. *C. tridentatum* is abundant, and *H. liberta* lives at the western end. Ha Mire Plantation, on the shore of the Tarn, has a wall round its landward side, and is of mixed coniferous and deciduous trees. The soil has a neutral reaction and the wood yields but eight species including three slugs, though one is *L. maximus.* The wall round Great Close Plantation has such species as *C. dubia* and *P. rupestris*, but the floor of the wood has but seven species, all indifferent to lime, the soil again being neutral. The little wood south of the Tarn Moss and known as Spiggot Hill has many larches, with deciduous trees round the outside. The ten species include four *Arion*, the *subfuscus* being very fine. *Oxychilus*, *Retinella* and *Vitrea* live there, and, oddly enough, *M. granulata*, not usually a woodland species.

There is a great deal of grassland in the Malham area. Pearsall (1950, 212) writes, " Wherever such rocks as limestone, basalt and dolerite outcrop, there are grasslands of sheep's fescue, with many other herbs and grasses, distinguished among upland habitats by the presence of snails, ants and earthworms. Though this type is of widespread distribution in British mountains it covers a limited area. It . . . finds its fullest expression in Southern England on the chalk downs. In the north and west, it is nearly always recognisable because it harbours moles and practically always rabbits. The second and commonest faunistic type is that of the poor Festuca-Agrostis grasslands, on base-deficient soils on which snails are replaced by slugs and where ants are absent and earthworms scarce."

Of the first type of grasslands there are several areas, of which a typical one is the slope on the west side of Malham Cove. The close-cropped turf reminds one of the chalk downs, except that here and there limestone boulders protrude through the grass. It is a typical *Helicella* habitat, and indeed *H. itala* lives there. One looks to find *H. virgata* amongst the clumps of thistles. In all thirteen species of snails are found on this slope, including both *R. radiatula* and *R. pura.* Rabbits occurred plentifully on this type of grassland, but myxomatosis had begun to invade the area in the summer of 1955 and many rabbits were seen in the early stages of disease.

On transitional drift and alluvium there are extensive areas of the Festuca-Agrostis grassland, and this, as Pearsall says, yields only slugs, generally only *Arion ater.* A much more interesting area of grassland is one on drift south-east of Malham Tarn, and this was examined with some care. The drift is very mixed, large areas being of Millstone Grit drift, which is acid. There are small hillocks of limestone drift, grown with calcicole plants and eaten so short by sheep that no snails live on them. There are also areas of mixed drift. Apart from the hillocks, the drift is dominated by mat grass (*Nardus stricta*), associated with sheep's fescue (*Festuca ovina*) and bent grass (*Agrostis tenuis*) in varying abundance. This acid grassland supports only *Arion ater* and an occasional *A. subfuscus*, but the molluscan issue is much confused by the presence of erratic boulders of limestone. The plants growing up the sides of these boulders have formed highly calcareous habitats and many small snails make their homes there. Five species of *Arion* live there. *A. reticulatus* is ubiquitous and *C. lubricella*, *P. rupestris*, *C. bidentata*, *O. alliarius*, *R. radiatula* and *R. nitidula* are also found there. On the slopes of Fountains Fell, above Darnbrook Beck, where the acid drift has no limestone outcrops or boulders, *Arion ater* lives alone.

As already mentioned, along the line of the North Craven Fault are small outcrops of Silurian rock. These are acid, and on a typical outcrop near Street Gate, the following species have been found; *C. bidentata*, *A. ater*, *V. crystallina*, *O. alliarius* and *R. pura*.

The areas of marshland vary a good deal in size, the largest being Great Close Mire. In wet weather it has to be crossed on the tussocks, which are dominated by *Carex flacca*, *C. panicea* and *Festuca ovina*, the muddy runnels between, in which grow *Carex lepidocarpa*, *Juncus articulatus* and *Agrostis stolonifera*, being very soft. In these muddy runnels live *Succinea pfeifferi*, *Lymnaea truncatula* and *Pisidium casertanum*. Other marshes and areas of boggy ground, differing in character from Great Close Mire, have, according to their nature and situation, such additional species as *L. peregra*, *S. putris*, *H. hispida*, *A. laevis* and in one instance *P. personatum*. The " Fen ", by Malham Tarn, harbours land as well as aquatic species, but being properly an integral part of the Tarn area will be dealt with later.

The association of the two species of *Succinea* with *L. truncatula* proved most interesting and their occurrence was carefully mapped. In only two places did *L. truncatula* occur without *Succinea*, and it was present in all but two of the *Succinea* loci. Both species of *Succinea* have been recorded many times since 1883 for various localities at Malham, but there seems to have been some uncertainty about identification. *S. putris* has been recorded both north and south of the Middle Craven Fault when in fact it lives only south of it. Roebuck (1890) refers to encrusted specimens of this species at Gordale Head. Only *S. pfeifferi* lives there, but many of the shells are a good deal weathered, so it is obviously this to which Roebuck refers. In 1955, *S. putris* was first found on *Juncus effusus* in a marshy patch by Gordale Beck opposite New Laith Barn, where it lived with *C. minimum*, *S. pfeifferi*, *C. lubrica*. *A. arbustorum*, *H. hispida*, *M. granulata* and *V. crystallina*; *L. truncatula* was also present. It occurs in other marshy places along Gordale Beck as far as Gordale Scar. It is suggested that this species spread upstream and has been prevented from further progress northward by the escarpment and the high fall at Gordale Scar. *S. pfeifferi* lives with it in much smaller numbers and *L. truncatula* is plentiful.

S. pfeifferi, several times in the past referred to as *S. elegans*, is found commonly in almost every marshy patch on the plateau; is found all round the Tarn except on the peat of the Tarn Moss; and in every piece of wet ground, however small, all along the upper reaches of Cowside Beck. In every instance but two, *L. truncatula* is present. The shells are very uniform in size when full grown and may show signs of weathering, which is not surprising considering how exposed is the terrain.

The *L. truncatula* of the marshlands are very small and much alike everywhere. There is, however, a colony below Janet's Foss Wood so amazingly different both in habitat and appearance that it is worthy of note. At the south end of the wood are great beds of nettles, with an occasional tree, but flanking the path by the beck side is a long narrow bed of wild garlic (*Allium ursinum*). At one point a fallen tree has caused a diversion to be made in the footpath; the old path has become grown with grass and in this lives a giant form of *L. truncatula*, the largest taken measuring 10 mm. compared with the average 4½ mm. of the marsh form. The snails also extend into the garlic bed, where they live with such species as *M. granulata*, *H. striolata* and *Oxychilus* spp. Another interesting habitat of *L. truncatula* is in moss in a tiny bed of *Carex*, by a tributary of Cowside Beck. These are the small form and the only associate is *Vitrea crystallina.*

Although the whole area is sheep country, there is apparently little or no instance of liver rot amongst the sheep, which is rather surprising in view of the prevalence of *L. truncatula*, nor has the bird fluke been detected.

In writing of the individual species, occasional reference will be made to Colt Park. This does not come within the area under review, being situated below Close Fell, the northernmost spur of Ingleborough and in Ribblesdale, some fifteen miles from Malham Tarn. It is quite famous and of very great interest. It is a limestone pavement about ¾ mile long along the side of the Fell and grown with ash trees. In many places the grykes are sufficiently wide to allow a person to get down to the bottom. The Mollusca had never been investigated until a visit was paid to it in 1955, when 30 species were found, all of which occur in the Malham area. Colt Park deserves close attention. The commoner Malham species will not be discussed as they occur generally in the same sorts of places as they do elsewhere, and some other species have already been dealt with.

Notes on Land Species

Carychium. C. minimum was recorded by Booth in 1910 for Tarn House Wood. Only *C. tridentatum* lives there and this is undoubtedly the species Booth meant. *C. miminum* has so far only been found in the bed of *Juncus effusus* opposite New Laith Barn, though it probably occurs in similar situations further down Gordale Beck. *C. tridentatum* occurs also on a dry bank at Malham village, on the scar above Middle House, on a stone wall, and, strangely enough, in the Fen by the Tarn, a *C. minimum* habitat.

Azeca goodalli, never an abundant species, has been found only in three loci; Comb Scar Gorge (described, Stratton, 1955), Malham Cove and Janet's Foss. It is much commoner than is usual at Colt Park.

Cochlicopa. C. lubricella is much more common than *C. lubrica* and most of the old records should be referred to aggregates of both. *C. lubricella* was found in 22 loci, *C. lubrica* only in 12, and in three only were they found together. *C. lubrica* was several times found in wet situations, *C. lubricella* not at all (see Quick, 1954, 211), and it was *the* wall species of the two.

Columella edentula. Recorded for the first time in 1955, in four loci, all dry and highly calcareous.

Vertigo pusilla. Described, 1882, as " very rare; in moss at Malham ", and 1890, " Malham," probably the same record. Has not been found since.

V. antivertigo. Found for the first time, 1948, but no locality given. In 1955, found in *Carex* in the Fen.

V. substriata. First record, 1955, in the Fen, with *V. antivertigo.*

V. pygmaea. " Very rare. Two examples, Malham, 1882," Soppitt and Carter. Dr. Quick found a number at Middle House in 1955.

Pupilla muscorum. Not common, Malham Village, 1882 and 1890. Found on a dry bank at Malham, 1955.

Abida secale. " Apparently rare, but abundant about Settle. Malham, 1871 (H. Shaw)," Soppitt and Carter. Not found at Malham since, though there are plenty of likely habitats.

Acanthinula aculeata. Surprisingly rare. First found, 1955 on a dry bank at Malham and at Colt Park. Occurs sub-fossil in Gordale.

Vallonia pulchella. Also rare. Malham village, 1891, W. D. Roebuck. Found again on dry bank, 1955.

Clausilia. Although many more loci were found for the two species *C. bidentata* and *C. dubia*, there is no reason to modify the statements previously made (Stratton, 1955). A specimen of *C. bidentata* with two mouths to the shell was found on limestone rock by Cowside Beck.

Balea perversa. Recorded several times. Roebuck (1890) says, " Occurs on walls in great profusion, Malham." Patient search on walls and trees at Malham failed to reveal it, but Dr. Quick found it on sycamore trees in the demesne of Middle House.

Cecilioides acicula. First found in 1955 on shelves on the limestone face of Highfolds Scar.

Arianta arbustorum. First recorded in 1882 and in every list since, with many varieties. The shells are very variable both in size and coloration. In some places the shells are as large as *H. nemoralis*, in others, as at Middle House, they might be referred to var. *alpicola.* In coloration, the shells tend to be pale with only a small proportion of dark ones. Both banded and unbanded shells are common. Roebuck (1890) says, " The var. *canigonensis* has occurred once." This unflecked form is fairly common in Comb Scar Gorge, several were found on Fountains Fell, and odd ones have turned up in several communities. The dark form of this variety, figured by Taylor (1914) as sub-var. *hypnicola*, also occurred in the Fountains Fell colony. The favourite habitat in this area seems to be nettle beds (see Ellis, 1926), but the species was found in places of varying dryness, from a wet bed of rushes in mud by Gordale Beck to a very dry limestone outcrop (see Stratton, 1954). An isolated colony in a nettlebed by Cowside Beck had every shell gnawed by rabbits.

Helix hortensis. Very few past records, but this snail is not uncommon. It shows little variation in banding and no self colours were seen.

Helix nemoralis. A common species, in all sorts of places—in nettlebeds, woods, on grass slopes and under scars. All but one of the old records refer to var. *libellula*, and in 1955 all the colonies found were yellows except one by Cowside Beck, where pinks occurred. Bandings varied a good deal and there was a proportion of self colours.

Hygromia. Although *H. hispida* was much the more common, *H. liberta* was found in seven loci. None of these was as wet as some of the places in which *H. hispida* occurred.

Monacha granulata. Not abundant, but occurred in four loci, all damp.

Punctum pygmaeum. Once recorded, " near Malham Tarn," was found in the Fen with both land and aquatic species.

Arion. All the five common species were found, and they are generally distributed. *A. ater* is the most common, and was found in every kind of habitat from very acid drift at 1,450 feet to a crack in a limestone scar; from a wet peat bog to a dry limestone hillside. All were typical black slugs except a single var. *brunnea* above Darnbrook Beck and two young with white sides and black backs.

Limax. L. maximus, previously recorded only from the garden of the Buck Hotel at Malham, was found in Ha Mire Plantation. *L. marginatus*, recorded for Gordale Scar, 1877, was found in 1955 on beech trees by the Tarn House after the only shower of rain.

Among the land Mollusca there are several notable absentees, and no doubt, given favourable weather, some of these will be added to the list. There is still plenty of ground in this area of 15 square miles yet to be investigated, and much of that already looked at will repay further visits.

AQUATIC HABITATS

In considering the watery habitats of the area, Malham Tarn (Fig. 3) must take pride of place, for it is undoubtedly unique in Britain. It lies at 1,229 feet above sea level and owes its presence to two factors. The first is an inlier of impervious Silurian rock against the North Craven Fault, this forming its bed; and it is contained on the south by morainic ridges.

About 15,000 years ago the Tarn covered about twice its present area of 153 acres, and the outflow was eastward into the head of Gordale. During this period, a large area on the western side of the Tarn became grown over with vegetation, passing through the various stages of fen and fen-carr, and laying down vast quantities of peat. Erosion of the containing moraine eventually resulted in a break through, and the formation of a stream which became the head waters of the River Aire. The water of the Tarn fell by some twenty feet, reducing its area to one slightly smaller than the present. The western portion became a raised bog, now known as Tarn Moss, growing heather, bilberry and many rare plants. It is divided into two parts by the inflow stream, and from the northern portion quantities of peat were dug.

The outflow stream flowed southward through the gorge below Comb Scar, over a cliff into the valley Watlowes and then made a spectacular plunge of 300 feet at Malham Cove. Later the outflow stream went underground at the place called Water Sinks, half a mile south of the Tarn, and now emerges at Aire Head Springs, south of Malham village. Malham

Beck emerges at the foot of the Cove, and this, long thought to be the outflow stream, is in fact the Smelt Mill Beck from further west.

In 1791, Thomas Lister, first Lord Ribblesdale who lived at the Tarn House, had a controlled outlet built at the southern end of the Tarn, thereby raising its level about four feet, though it did not much increase its area. This resulted in two things. The first was the flooding of the dug-out portion of the Tarn Moss, and this became colonised by aquatic vegetation, and it is to this part that all the older records of Mollusca for the Tarn Moss refer. As it is quite different from the main mass of the Moss, it will for convenience be referred to here as the Fen, though only parts of it are true fen. The second result was the creation of a new shore-line. This is best described in the words of Mr. P. F. Holmes, who writes (1955):

" The shore-lines vary according to the nature and gradient of the shore and to the degree of exposure to winds, though the general slope is very gentle in conformity with the shallowness of the basin. Along the northern and north-eastern shores there is limestone not far down, but with a variable depth of drift and scree debris over it; wave action here has produced a mixed shore of large boulders and stones of various sizes. The southern and south-eastern shore-lines have been produced by the erosion of glacial drift only, and they vary according to the nature of that drift; there are two small embayments where the drift is derived from sandstones, a few patches of shingle, but mostly the shores there are made up of stones of limestone and so do not differ greatly from the northern shore. On the western side . . . a vertical peat bank forms a marked contrast. All these shores are exposed to the scouring effects of wave action at one time or another, and there are in fact only two small bays sufficiently sheltered from the wind for sediments to accumulate: one is the inflow bay and the other is on the eastern side near Great Close Scar. Here beds of sedges, predominantly *Carex rostrata* are established, with a zonation of other marsh plants on their landward side.

" When the slope of the ground is neither too steep nor too gentle, a small wave-cut platform has been formed just offshore, which is best developed on parts of the northern side of the Tarn. On these flat areas small stones are mixed with calcareous gravel and mud or sometimes with clay from the drift. On the offshore side of such a platform, however, is a wide zone of stones and boulders, which is similar to that of the present day shore. This zone must represent the pre-1791 shore-line, before the level of the Tarn was raised, and it shelves steeply into deeper water. In times of calm weather the outline of this old shoreline can be clearly seen as a series of big boulders under water, lying along the edge of the shelf. Where the slope of the shore is steeper, or perhaps where there is less drift, the two shore-lines are contiguous, with no platform between them; while along parts of the eastern shore there is only a very slight slope of land down to the water's edge and the bottom shelves very gradually away from it. From the western peat bank a fairly level underwater platform of peat, pitted with hollows, extends outwards for some distance, representing the amount that the edge of the Moss has been cut back in the last 165 years."

All the middle of the Tarn has a bottom of black organic mud. Under the old shore-line along the northern side grow large areas of *Chara deli-*

catula, while in the centre of the Tarn, in 14 to 15 feet of water, are great beds of *Myriophyllum spicatum* and *Potamogeton lucens*, which reach the surface in summer but die down completely in winter. The main feeder stream, entering the Tarn in the north-western corner, forms quite an " estuary." The southern bank of this is the peaty margin of the Tarn Moss, but the northern bank is plentifully grown with aquatic vegetation, chiefly the bottle sedge *Carex rostrata*. Both parts of the Tarn Moss must be considered with the Tarn, for not only were they originally parts of it, but they support aquatic and semi-aquatic Mollusca.

The main mass of the Tarn Moss rests upon a base of Late Glacial lake clay. Above this is a stratum, about 10,000 years old, of calcareous marl, which contains *Valvata cristata*, *Lymnaea peregra*, *Planorbis albus*, *P. contortus*, *Sphaerium corneum* and *Pisidium obtusale*. Of these *L. peregra* is fairly common in the Tarn today, the two *Planorbis* and *Sphaerium* are abundant, and although *V. cristata* was not recorded until 1947, it was probably there all the time. *P. obtusale* was found in 1955 in the Tarn outflow and may yet be found in the Tarn. Above the Marl is a thick layer of Fen and Brushwood peat, containing the remains of willow and birch, while the surface layer, much the thickest, is of Sphagnum peat.

North of the inflow stream, the Fen varies from swamp, with *Carex rostrata*, through fen, with other *Carex* species, ragged robin (*Lychnis flos-cuculi*) and marsh marigold (*Caltha palustris*), to fen-carr, dotted with willows and alders, and finally raised bog in the more elevated parts.

Before going on to discuss the molluscan inhabitants of the Tarn, two other factors affecting them must be considered. The Tarn is very exposed and freezes over every winter for varying periods, and in the winter of 1954–5 the ice was about four inches thick. For a considerable part of the time the ice is covered with snow, so that the water below is rather dark.

The second factor is the important one of calcium. Malham is one of the few tarns in northern England which has a high calcium content, due to the fact that the waters feeding it flow from the limestone. Boycott (1936, 157) gave varying figures: today they fluctuate between 62 and 142 milligrams of calcium carbonate per litre. He especially remarks on the favourable influence of lime on Mollusca and says of Malham, " *Lymnaea stagnalis*, *Planorbis nautileus* (*crista*), *Bithynia tentaculata* and *Pisidium amnicum* are unknown elsewhere at more than 1,000 feet, and the fauna of Bwch Llyn at 970 feet (in North Wales) gives similar evidence of the encouraging influence of lime . . . No other loci for *Lymnaea stagnalis* approach these altitudes and I know of no other place at 1,000 feet or over with anything like their faunas." Boycott then lists the following species for Malham Tarn:

Ancylus fluviatilis
Lymnaea stagnalis
L. peregra
L. palustris
Planorbis albus
P. crista
Planorbis contortus
Physa fontinalis
Bithynia tentaculata
Valvata piscinalis
Sphaerium corneum
Pisidium amnicum
P. casertanum
P. hibernicum
P. lilljeborgi
P. nitidum

He probably left out *Planorbis leucostoma* and *Pisidium subtruncatum* considering them not to be Tarn species, as the former is recorded by

Roebuck (1890) as "*P. spirorbis*, Malham Tarn Moss", and the latter by Fysher (1929) for the Tarn outflow, though it was found in the Tarn in 1955. Although *P. milium* is in the Oldham Collection, Boycott did not record that either. Additions since Boycott's paper are *Valvata cristata*, 1947; *Potamopyrgus jenkinsi*, 1950; *P. personatum*, 1955; and *P. obtusale* in the Tarn outflow, 1955

Boycott (1936, 147) writes; " Since practically all the ground over 1,500 feet is on the older, siliceous rocks, the water in high loci also differs from that in lower places by being soft and often very soft with the single exception of Malham Tarn at [1,229] feet in north-west Yorkshire, which is the only calcareous mountain lake in Britain and as will be seen an illuminating place." While in actual fact there are one or two other ' calcareous mountain lakes,' the rest of his statement is true, and he then goes on to list the British freshwater Mollusca occurring at or above 1,000 feet, and from this list it would appear that Malham Tarn is the highest locus in Britain for *V. piscinalis*, *B. tentaculata*, *L. stagnalis*, *P. fontinalis*, *P. leucostoma*, *P. crista* and *Pisidium amnicum*. To these should be added *Valvata cristata* and *Potamopyrgus jenkinsi*; while Gordale Head, also 1,229 feet, is now the highest locus for *Pisidium pulchellum*. Malham Tarn is also the second highest locus for *Planorbis albus*, *P. contortus* and *Sphaerium corneum*.

Of the rocky shores of the Tarn, Three Trees Bay on the northern side is the most prolific, both in species and in the number of snails. Nearly every stone yields its quota of *A. fluviatilis* and *P. jenkinsi*, while the two *Planorbis*, *albus* and *contortus*, are common everywhere. Though not as abundant as elsewhere *L. stagnalis* frequently occurs, *L. peregra* is slightly more plentiful and *L. palustris* is found fairly often but the shells are small. *V. cristata* and *P. crista* are probably more common than would appear, no doubt due to their small size causing them to be overlooked. Although the rocky shore is not their true home, *B. tentaculata* and *V. piscinalis* are sometimes taken alive. Early in April 1955, while the Tarn was still covered with nearly four inches of ice, *A. fluviatilis*, *P. jenkinsi* and *P. contortus* were found to be active on stones beneath the ice. The rest of the northern shore and the eastern shore have as their commonest species *A. fluviatilis* and *P. contortus*. *P. crista* has been found along the eastern shore in some numbers but is erratic in its appearance. The other species are found only in small numbers.

Of the *Chara* beds, *C. aspera* supports *P. jenkinsi* in vast numbers, *V. piscinalis* and *B. tentaculata* are rather more plentiful than among the rocks inshore, and *P. albus* occurs, but not *P. contortus*, which seems to prefer to sit on rocks and stones. In the calcareous gravel and mud amongst the *Chara* seven species of *Pisidium* have been found. They are *P. casertanum*, *P. subtruncatum*, *P. milium*, *P. personatum*, *P. hibernicum*, *P. nitidum* and *P. lilljeborgi*. The *Chara delicatula* beds beyond the old shore-line are obviously the most favourable habitat of *L. stagnalis*, *V. piscinalis* and *S. corneum*, for here they are found at their maxima in numbers. B. *tentaculata* is also found in greater quantity, though it is most abundant still further off-shore. These three species appear to prefer deeper water, and their numbers steadily increase with depth.

The eastern sedge bed is, as it were, a pocket of deep mud with *Carex rostrata.* Owing to the depth of the mud and the softness of the shore, it is not easy to investigate. However, in 1955 ten species were found there, though only *L. stagnalis* and *L. palustris* occur in any numbers. The latter reaches a good size. *L. peregra* and *S. corneum* were sparse, and the few *V. piscinalis*, *B. tentaculata*, *P. contortus* and the single *P. leucostoma* appear to be strays. *Pisidium casertanum* and *P. subtruncatum* live in the mud in small numbers.

The north western sedge bed is quite different, being much more thickly grown, with *Carex rostrata* as the dominant sedge, and a succession of other marsh plants on the landward side. There is no definite shore-line, and here is a typical habitat of *Planorbis leucostoma*, which is quite abundant. This and *Pisidium personatum* are the commonest Mollusca, with *L. palustris* fairly common and other species less so. An occasional *Physa fontinalis* has been taken here from time to time.

The great beds of *Potamogeton lucens* and *Myriophyllum* are the true home of *B. tentaculata* and *P. fontinalis*, for here they occur in their greatest numbers, and reach their maximum size. *L. stagnalis*, though less common than in *Chara delicatula*, reach their greatest size here. *V. piscinalis* is also quite common. Their distribution, however, is patchy, being abundant in some places and scarce in others.

Along the south shore few living Mollusca are found, except in the two sandy bays previously mentioned. Both have floors of fine, gritty sand, though the one in the south-western corner has a certain amount of peat debris mixed with the sand, it being at the southern extremity of the Tarn Moss. In the sand *Pisidium lilljeborgi* is found.

The peat-bank shore seems to have no living Mollusca at all. All round the Tarn, large numbers of dead shells are washed up, giving an idea of the vast population of this piece of water, but it must be stressed that in considering the distribution of Mollusca in the Tarn, only living ones have been taken into account.

Although in past records, Malham Tarn Moss has been given as the locality for several species, the recent findings show quite clearly that they refer only to that part of it here called the Fen. The main mass of the Tarn Moss is nearly all acid raised bog and the only mollusc observed on it was *Arion ater*. There is, however, a flush from Spiggot Hill which is much less acid, and here, amongst the roots of buckbean (*Menyanthes trifoliata*), were found *Pisidium personatum* and some very fine *L. palustris*.

Normally the Fen is very wet and in some places considerable circumspection is necessary in negotiating it, but in 1955 it was so dry that it could be traversed in ordinary shoes. In the middle is an open hummocky area, and in 1954 *Arion ater* was seen here, possibly its only mollusc. Several muddy patches grown with *Menyanthes* and patches of yellow flag (*Iris pseudacorus*) had *L. truncatula*, *L. palustris* and *Succinea pfeifferi* in large numbers. An acid area on the edge of the willow thickets was carefully examined. Here, in mixed Carex fen with patches of Sphagnum, land and aquatic species were found together. On *Carex* were *Vertigo antivertigo* and *V. substriata*; in the dead vegetation below *Vitrea crystallina*, *Punctum pygmaeum*, and, rather surprisingly, *Carychium tridentatum*. *C. minimum* might have been expected, but was not found. All the snails were found alive; no dead shells were seen and Dr. Quick suggests that these rapidly disintegrate owing to the acidity of the site. In muddy runnels beneath the vegetation were many *Planorbis leucostoma* and large numbers of *Pisidium*, the seven species comprising *P. casertanum*, *P. personatum*, *P. milium*, *P. subtruncatum*, *P. hibernicum*, *P. nitidum* and *P. lilljeborgi*. This odd assortment seemed to be living together quite happily in an area of only a few square yards. Much of the Fen remained unexamined, and a week could profitably be spent on this interesting area.

The outflow stream at the south end of the Tarn may well be considered with it, being as it is a self-contained piece of water by going underground at Water Sinks. The water normally leaves the Tarn down a gently-sloping sluice, but in times of drought a hatchway beside it can be opened to let off more water. Water Sinks itself consists of absorption through a gravel bed to underground fissures. In June 1954 the stream went to ground sixty or seventy yards north of the old sinking point. On one occasion during the winter of 1954–5, for the first time in many years, the stream, or torrent as it had become, poured along its old course through Comb Scar Gorge, over the dry waterfall into Watlowes, but did not reach the Cove. In August 1955 there were several hundred yards of dry stream-bed above the Water Sinks. The Mollusca extend from the sluice to a pool immediately south of the road by Low Trenhouse and are mostly of those species found in the Tarn, from which they are probably derived. The commonest is *L. palustris*, of which hundreds of dead shells were seen beside the shrunken stream. There are some *L. peregra*, a few *L. stagnalis*, *P. albus* and *P. contortus*, many *A. fluviatilis*, some *S. corneum*, *Pisidium subtruncatum* and *P. obtusale*, this being the only locus so far found for the latter.

The other waters of the area consist of the three systems of Cowside Beck in the north, which flows eastward to the River Skirfare, and Malham and Gordale Becks, which unite south of Malham village, and form the head waters of the River Aire. Cowside Beck is a rocky, boulder-strewn stream. While it contains many mosses and algae, other plants are absent, and so, apparently, are Mollusca. This also appears to be true of its tributary, Darnbrook Beck, which comes down from Fountains Fell, and in many places flows underground. Tennant Gill is a much smaller but swift-flowing mountain stream, and in this, at 1,600 feet, *Ancylus fluviatilis* occurs, small and with the tops of the shells worn with the force of the current. Below its junction with Darnbrook Beck, Cowside Beck flows between the steep hillsides with scars in some places, but above the junction the valley is wider and there are many marshy areas grown with *Carex lepidocarpa*, *C. panicea* and *C. flacca*. Some of these yield *Lymnaea peregra*, but in every patch of marsh are found *Lymnaea truncatula*, *Succinea pfeifferi* and *Pisidium casertanum*.

Malham Beck, at its point of issue at the foot of Malham Cove, is rocky and contains many huge boulders fallen from the cliff above. The smaller rocks are grown with aquatic mosses and here *Lymnaea peregra* is common and the white form of *Ancylus fluviatilis*, first mentioned in 1890, is still abundant. Further down stream in Malham village the stones are generally smaller and clean, and only a few *A. fluviatilis*, of the normal form, may be found.

Gordale Beck, flowing along a steadily deepening valley, reaches the lower ground at Malham by way of two waterfalls. Two small streams, one from Great Close Mire and one from the marsh south of Great Close Hill, flow into a pool known locally as Gordale Head, though not marked as such on the map. The first of these streams contains *L. peregra* and *Pisidium casertanum*. Gordale Head is just over 300 yards long and is ten to twelve yards wide, broadening out near its outflow. Though up to two feet deep in a few places, it is mainly about a foot deep or less. The bottom is covered with some two inches of very fine mud and there is a gentle flow through it; there is almost no vegetation. The only gastropod is *L. peregra*, the largest found in the area. These snails crawl about on the mud, leaving behind them long mucous trails which undulate gently when the water is disturbed. Well-grown specimens of *Pisidium amnicum* occur here, with *P. milium*, *P. nitidum*, *P. subtruncatum* and *P. pulchellum*. Below Gordale Head, the Beck is stony, and *L. peregra* occurs only in the more level reaches, though it is common in a tributary flowing across Great Close Mire. South of Mastiles Lane the Beck enters the gorge of Gordale, and on reaching the edge of the escarpment, flows through a " window " in the cliff face and plunges downwards in a double fall some 100 feet high.

Below the fall the stream bed is a jumbled mass of limestone rocks, gleaming white in the water, with neither plant nor snail; but some 300 yards further south it is joined by a small stream arising in springs at the foot of Cross Fields Knotts, an extension of Gordale Scar. This stream is densely grown with watercress (*Nasturtium microphyllum*), which is swarming with *L. peregra*. In this stream was found a specimen of *L. truncatula* crawling on a stone three inches under water, the first time the author has seen this species in such a situation. In a marsh patch grown with several species of *Carex*, at the junction of the two streams, it occurs with *Succinea putris* and an occasional *S. pfeifferi*, *Pisidium casertanum* and *P. personatum*.

About half a mile down stream another fall is reached, Janet's Foss, only about fifteen feet high, but very beautifully situated. *L. peregra* again occurs in the pool below the Fall, but further down stream no snails have been found. Further south, where the valley begins to open out and just above New Laith Barn, is a large marsh in which the dominant plant is *Carex acutiformis*. Here *L. peregra*, *S. putris*, *P. casertanum* and *P. personatum* are common, *S. pfeifferi* less so, with an occasional *Agriolimax laevis*. Further still down stream Gordale Beck unites with Malham Beck to form the River Aire. Unfortunately there was not enough time to visit this area, and the molluscan populations there require investigation.

In normal years numerous pools of water exist on the plateau, and certainly deserve attention, as does the Smelt Mill Beck, whose waters emerge at the Cove as Malham Beck. Several side streams of Lower Gordale Beck should be investigated and much work needs to be done on the Tarn and the Fen. Where in the Tarn is the true home of *Pisidium amnicum*? A single juvenile shell found after a lapse of over 50 years is not enough to go on. The molluscan population of the Fen is obviously very great, and probably even more varied than has been described.

NOTES ON THE FRESHWATER SPECIES

Valvata cristata. Specimens from the Tarn were first identified as this species in 1947 by T. T. Macan. In 1951 it was not uncommon; in 1954 several were found along the north shore on stones. It was fairly common early in 1955 along the east shore, again on stones, but in August prolonged search failed to reveal a single example.

Valvata piscinalis. First recorded in 1883 by Roebuck and Butterell, who describe it as approaching var. *acuminata.* In 1891 Roebuck writes of it as a " very prolific species in the Tarn ". It is locally common, especially in the *Chara* beds. It occurs in small numbers in the sedge-beds; was common in 1954 in *Chara delicatula* and was taken occasionally along the shore. Mr. Holmes says it must be commoner than appears as large numbers are often taken from the stomachs and intestines of trout.

Bithynia tentaculata. In 1887 was recorded for the margin of the Tarn, " numerous and fine, although dead examples." Roebuck found but few, but the species is in fact quite common on *Potamogeton lucens* and *Myriophyllum*, rather less so in the *Chara* beds, and is sometimes taken alive inshore among rocks and in the sedge-beds.

Potamopyrgus jenkinsi. Was found in Coniston Tarn, 6½ miles south of Malham, by G. Fysher in 1929, but was not found in Malham Tarn until 28 May 1950. It was then found to be abundant at the mouth of the inflow stream and along the north shore as far as the West Boat House. Very few were found beyond this point, but by September it had greatly increased in numbers all along Three Trees Bay. By 1954 it had become very abundant there and the bed of *Chara aspera* in the Bay was swarming with the snails, but so far none had succeeded in getting beyond Three Trees Point, where the water shelves rather more steeply. In August 1954 some 2,000 snails were transplanted beyond the Point and by the following year had begun to spread, though very slowly. The results of this experiment are awaited with great interest.

Lymnaea palustris. First recorded in 1910, it is now quite frequent round the shores of the Tarn and in the sedge-beds. The shells vary a good deal in size. Along the rocky shores they are generally small; several quite large ones were found in the east sedge-bed in 1954. Medium sized shells are common in the Fen and abundant in the outflow stream, but the largest are found amongst *Menyanthes trifoliata* in a flush on the Tarn Moss.

Lymnaea stagnalis. More has been written about this species than any other found in Malham Tarn. First recorded in 1883, the Tarn shells have many times been referred to as var. *fragilis-variegata.* In 1890 Roebuck writes, " *L. stagnalis*—are marked by white streaks in somewhat irregular alternation with the horny ground colour of their shells, a phenomenon which American authors in treating of similar instances in the Rocky Mountains States ascribe to the alternations of cold and warmth to which water-shells are necessarily subjected in localities lying at so great an elevation as Malham Tarn does in comparison with the localities in lowland plains usually occupied by such species." Fysher in 1925 refers only to var. *fragilis*, and in 1929 writes, " rather undersized and not including any of the banded form once found by the late Roebuck after a severe and variable winter."

L. stagnalis now occurs most frequently in the *Potamogeton* and *Myriophyllum* in the middle of the Tarn and in the beds of *Chara delicatula*. It is found fairly often along the rocky north and east shores, though never in any numbers. In 1954 over a hundred were taken in a short time in the eastern sedge-bed. Of all the many hundreds of shells examined in 1954 only one might be said to have a white streak and that only on the spire. The shells were fragile and generally of small size, with very narrow pointed spires. In 1955 the shells taken from the *Potamogeton* were unmarked, while some taken in Three Trees Bay had traces of streaks on the spires. Some of the largest shells yet found were taken in a small bed of *Myriophyllum* at the Tarn outlet, and most of these had well-marked white streaks, but only on the spire. Three young specimens were taken alive in the north-west corner of the Tarn between the sedge-bed and the West Boat House, all beautifully marked on spire and body-whorl alike. These were almost certainly hatched in 1955, so that winter coldness could not have affected them and the body-whorls at least must have been produced during a hot summer.

Lymnaea peregra. The most widely distributed freshwater snail in the area, it occurs in the Tarn and in becks, gills and marshes on the plateau and at Malham. Roebuck (1890) says, " var. *ovata* occurs in Malham Tarn; var. *acuminata* has been found at Malham, but is not characteristic. This form is very peculiar; Dr. E. von Martens has referred it to *L. lagotis* Kob." Today the shells vary a good deal in size and shape in different loci. Those in the Tarn seem to approach the *lagotis* form of *Lymnaea*, and are generally small and fragile. Well grown specimens of the *ovata* form live in Gordale Head, and fair-sized ones in the pool below the Fall at Janet's Foss. It occurs generally, though small, in Great Close Mire and other plateau marshes; all along Gordale Beck; abundantly in a spring stream amongst watercress below Gordale Scar; in Malham Beck at the Cove, and in marshes at Malham and along Cowside Beck.

Physa fontinalis. Roebuck recorded a single specimen from the Tarn in 1891. Apparently it was not found again until 1948, when Mr. Holmes found it " locally quite common on *Potamogeton lucens* and *Myriophyllum*, and is often found to be the commonest mollusc on *Potamogeton*, while in another patch it may be scarce ". It is sometimes, though rarely, found inshore on rocks and has several times been found in the sedge-beds. It was once found on cow dung in the spring stream below Great Close.

Planorbis leucostoma. Roebuck recorded it in 1890 as common in Malham Tarn Moss, but it was not mentioned again until 1950, when Mr. Holmes found it " in some numbers " in the north-west sedge-bed. In 1955 it was again found to be frequent there and in certain parts of the Fen it was abundant. Specimens are generally rather small.

Planorbis albus. Recorded in 1891 and 1910. It is common in the Tarn all along the rocky shores, in the sedge-beds, the *Chara* beds and on *Potamogeton*. Full grown specimens reach a fair size.

Planorbis crista. One found in 1888, several in 1891. In 1950 a few were found on the north-west shore in May and on the east shore in August. In June 1951 it was fairly common on the north-west shore. Early in 1955 it was found in some numbers along the east shore but was not found there in August.

Planorbis contortus. From 1888 onwards has been recorded as being fairly common in the Tarn. It is found abundantly on stones all along the north and east shores, but it is only of medium size.

Ancylus fluviatilis. First recorded in 1880. Roebuck in 1890 writes, " var. *capuloides* has been found, Malham; var. *albida* is common in the River Aire just where it issues from Malham Cove." *A. fluviatilis* is abundant in Malham Tarn, full grown specimens being of a large size. It is found all round the Tarn on rocks, stones and shingle. Mr. Holmes says that on 28 June 1951 he found that young about 1 mm. long were beginning to appear. In August 1955 few adults were to be seen, though small snails were everywhere. In June 1954 medium sized *Ancylus* were found at 1,600 feet in Tennant Gill, a swift mountain stream on the slopes of Fountain's Fell. The white form is still common at Malham Cove. It is interesting to note the apparently complete absence of *Ancylus* from Gordale Beck, above the falls, in comparison with its abundance in the Tarn, the outflow stream and Malham Beck. Mr. Holmes suggests that this is due to the profuse deposition of tufa on the stones in Gordale, and this is probably correct. The tufa gives a rough, knobbly surface to the tops of the stones, and the *Ancylus* cannot sit comfortably on them. It was most noticeable that, providing the stones in the other loci were submerged, the snails occupied only upper surfaces, being seldom found on the lower parts.

Sphaerium corneum. " Not uncommon " in 1883. In 1890 Roebuck writes, " var. *nucleus.* Dead specimens abundant in Malham Tarn in September 1883; J. D. Butterell and W. D. R. Mr. Butterell remarked that the dead shells were peculiar in shape, and having the young fry very noticeable at the unbones somewhat after the manner of *S. lacustre*, and that living specimens should be procured, as he is inclined to believe that perfect examples will in some cases show the same alternation of white bands with the ground colour as the *L. stagnalis* var. *fragilis.* The specimens obtained were also slightly inequilateral and very tumid." In view of this statement, special note was taken of the species in 1954 and 1955. The majority of the full-grown shells showed this peculiarity of shape, though there was no sign of white banding. The fry stands out prominently at the unbones, though it is hardly correct to compare it with *S. lacustre.* Half-grown shells showed no signs of this strange growth. It is suggested that the " *nucleus* " shells were born late in the year, and that during the winter, when the water is very cold and the Tarn undergoes periods of freezing, possibly with snow cover, all growth ceases until the following spring, when it is resumed in a new plane. The junction between the fry and the rest of the shell is very thin and fragile and it is common to find complete empty shells with the fry portion gone. The living shells have to be cleaned very carefully or they will fracture along this junction line.

Half grown shells found in August are quite normal; they are probably from broods born early in the year, after the winter is over, and by the following winter will be too large to be affected by the cold and produce the small number of smooth adult shells. It will be seen from this that there are two forms in the Tarn.

S. corneum is most abundant in the beds of *Chara delicatula*, where it is found in great numbers. Odd specimens have been found in the *Potamogeton* and *Myriophyllum* beds; more in the east sedge-bed and in small numbers along the rocky shores.

Pisidium amnicum. Recorded from Malham Tarn, 1888. The only other record is that of J. Davy Dean, who exhibited it from the Tarn at a meeting of the Conchological Society in 1902. In 1955 a very small specimen was taken with *P. lilljeborgi* in the sandy bay in the south-west corner of the Tarn, although this seems unlikely to be its usual habitat there. It is an interesting specimen in that the posterior lateral teeth of the hinge are reversed—the left and right valves have exchanged the posterior laterals. Fine, large specimens live in Gordale Head.

With regard to the smaller species of *Pisidium*, there appears to have been a good deal of confusion, and a sorting out of records has been badly needed. In some cases, records were not published at the time of finding the species; for instance, it would appear that *P. lilljeborgi* was first identified as such by A. W. Stelfox in 1910, but the record was not published until Oldham mentions it in 1929. *P. hibernicum* was identified by Stelfox in 1920, but its first appearance in print seems to be in Boycott's list in 1936. Of a meeting at Malham of the Yorkshire Naturalists' Union on 4 June 1910 F. Booth writes (*Naturalist*, 1910), " Some time was spent in collecting *Pisidia*, in an endeavour to ascertain the number of species of these small bivalves inhabiting the Tarn. Of those collected, Mr. J. W. Taylor suggested from a casual survey, that there would be four species." These shells were sent with others to Stelfox, and his manuscript notes reveal the following, " Malham Tarn, N. Yorks, 4–6–10. *P. milium*, *P. subtruncatum*, *P. lilljeborgi*." Stelfox returned the shells to Booth, but he records in a list following the above quotation, *P. fontinale*, *P. pusillum* and *P. nitidum*. In all, seven species of *Pisidium* had been identified by 1920, yet in 1936 Boycott lists only five, omitting *P. milium* and *P. subtruncatum*.

In all the records of *Pisidium* only two give anything like exact loci, Roebuck (1890) giving the Tarn Moss (probably the Fen) for *P. nitidum*, and Fysher (1929) the Tarn outflow for *P. subtruncatum*; so in 1955 the Yorkshire Naturalists' special effort was repeated, as far as possible for the whole area. The results were submitted to Mr. A. E. Ellis, and Mr. A. W. Stelfox has also seen the material. The number of species of *Pisidium* for the area is now ten, nine of which are found in the Tarn or the Fen adjoining it. All the 1955 loci have been mapped; there are doubtless many others, but future workers will at least know where to start.

Pisidium casertanum. " *P. fontinale*, bogs at Malham, 1888, Soppitt and Carter; Malham, 1890, W. West and Malham Tarn, 1910, F. Booth," may be this species, although it was not in Booth's sending to Stelfox, 1910. In 1955 it was found in the Tarn in Three Trees Bay, in the two sedge-beds and in the Fen. It also occurs in marshes all along Gordale Beck, on the Plateau and in every marshy patch along Cowside Beck. It is by far the commonest species in the area.

Pisidium personatum. Although not discovered until 1955, this species is fairly common and inhabits a variety of places. It is most abundant in the north-west sedge-bed and in the Fen, of which the latter corresponds most nearly to Ellis's description as " reed beds and carrs in company with hygrophilous land snails ". In the Fen it lives with six other species of *Pisidium*, *Planorbis leucostoma* and several land species. It lives with *P. casertanum* in marshes by the north-east inflow stream, by Gordale Head, below Cross Field Knotts and near New Laith Barn. It also lives in the Tarn in Three Trees Bay amongst *Chara aspera* in two to three feet of highly alkaline water subject to a good deal of movement. Of its habitats Alkins (1925) writes, " finds its most favourable habitats in the stagnant, muddy drainage ditches which are liable to dry up in dry weather," and Boycott (1936, 136) says, " stagnant water, puddles and temporary ponds, sometimes wet places on land, prefers bad places "; while Ellis (1940, 62) prefaces the above comment by saying, " It is tolerant of soft water and thrives in places where other Mollusca are rare or absent." In Three Trees Bay *P. personatum* lives with six other species of *Pisidium* and numerous gastropods. Commenting on this curious habitat, Stelfox probably sums it up in the best way by saying, " Accidents will happen."

Pisidium obtusale. A single specimen was taken in 1955 in the Tarn outflow stream. This habitat is the complete opposite to that given by Alkins as " in stagnant marshy or ditch areas with much floating grass, with no visible flow of water and with an almost complete absence of mud." This specimen was found in mud accumulated by a strong eddy or back-flow at the foot of the sluice from the Tarn. There was no weed of any kind. It was living with *P. subtruncatum*, a species not mentioned as an associate by Ellis or Stelfox.

Pisidium subtruncatum. This was among the species sent to Stelfox by Booth in 1910, apparently from the Tarn, but it was not recorded until 1929, by Fysher, and then from the Tarn outflow. This was also sent to Stelfox, and his notes for 1929 refer to " one very thick, very inequilateral, medium-sized shell ". Of the species Ellis writes, " It prefers running water, but is also found in lakes, ditches and ponds." At Malham, it occurs in some numbers in the outflow stream, in the *Chara* bed in Three Trees Bay, in the east sedge-bed, in Gordale Head, all covered by Ellis's description, but also in the Fen, whose nearest equivalent is possibly ditches.

Pisidium milium. Although included in Booth's sending to Stelfox, no record of this species seems to have been published. In 1955 it was found in Three Trees Bay, in Gordale Head and in the Fen. Ellis says, " in ponds, tarns, canals, marsh drains and rivers, but not usually in swamps." The Fen provides an instance of a less usual habitat.

Pisidium lilljeborgi. Of this species, Boycott (1936) writes, " in fine gritty sand or silt, not in mud, and characteristically in mountain lakes both at high altitudes and near sea level; hence mostly in soft water; it lives, however, in hard water in Malham Tarn and Gormire in Yorks, and the determining factor seems to be the nature of the bottom rather than the water." Specimens were sent to Stelfox by Booth in 1910 and 1920. Of the former Stelfox says, " A glorious form. The finest I have ever seen, both in actual size and thickness of hinge. This is the *nitidum* var. *splendens* of Jeffreys " (Jeffreys, 1862), and may be what Booth meant by his *nitidum.* It is first mentioned by Oldham (1929), when he recorded the Gormire specimens, as having been found in Malham Tarn " some years ago ". In the Oldham Collection is an undated specimen from Malham Tarn and two lots dated 1918 and 1920, the latter from F. Booth.

As no locus in the Tarn had been given, one of the first enquiries on arrival at Malham in 1954 was, " Where is there sand ? " This proved to be in two small bays on the south shore. Only the middle bay was examined, and here, in " fine gritty sand," fine large specimens of *P. lilljeborgi* were abundant, shells which Stelfox describes as " typical Malham *lilljeborgi* ". In 1955 the character of the bay was completely changed. The sand was still there but dotted all over it were fist-sized stones, between which grew *Chara aspera*. *P. lilljeborgi* was distinctly scarce and had to be searched for carefully. What the cause is of this decline in numbers is difficult to say. At first it was thought to be caused by the invasion of the bay by the *Chara*, but the finding of the species in the *Chara aspera* bed in Three Trees Bay seems to dispose of this theory. Another suggestion is that the rolling about of the stones in rough weather may have crushed and killed off many of the bivalves. The shells from Three Trees Bay Stelfox describes as " a curious, small, thick form ".

The species also lives in some numbers in the bay in the south-west corner of the Tarn in sand mixed with peat debris; they are of good size but " extraordinarily thin-shelled ", writes Stelfox. The most remarkable thing was finding it in the Fen in company with six other species. Writing of the shells from this locus, Stelfox says, "The Fen is certainly an extraordinary place to find it and I suggest it may be a relic from a time when the habitat was different from what it is now. A species may linger on a long time in a changing environment, though doomed. I looked at these shells without looking at the label and thought that most were a very strange form of *hibernicum*. They are a very queer lot, though I feel that Ellis must be right, for the ligament pit seems much too narrow and straight to be *hibernicum*. I have, however, never seen *lilljeborgi* like these from the British Isles, but I believe I remember some from Norway like them and difficult to separate from some forms of *hibernicum*." It seems doubtful if the Fen was ever anything like a typical *lilljeborgi* habitat, so that its presence there is difficult to account for. It would also appear that the species has four forms in this very small area.

Pisidium hibernicum. First recorded in Boycott's list, 1936, but Booth sent it to Stelfox in 1920. There is a single specimen from the Tarn, undated, in the Oldham Collection. In 1955 it was found to be fairly frequent in the Fen, again an unexpected habitat, and a single specimen was taken in Three Trees Bay.

Pisidium nitidum. First found in 1883, recorded in 1888, and regularly from then on in the Tarn and once at " Janet's Foss Beck ". Some of these earlier records probably refer to *P. lilljeborgi*. In 1955 it was found in Three Trees Bay, in the Fen and in Gordale Head.

Pisidium pulchellum. First found in 1955 in Gordale Head, a typical habitat. This is a new vice-county record, and at 1,229 feet it would also appear to be the highest locus in the British Isles for the species.

From the foregoing notes it will be seen that in the Malham area a number of the species of *Pisidium* inhabit unusual places, as well as the more usual ones. The following table sets out their distribution in the different kinds of habitats.

Habitats	1	2	3	4	5	6	7	8
P. amnicum . .		X					X	
P. casertanum . .	X		X	X				X
P. personatum . .	X		X	X		X		X
P. obtusale . .					X			
P. subtruncatum .	X		X	X	X		X	
P. milium . .	X			X			X	
P. lilljeborgi . .	X	X		X				
P. hibernicum .	X			X				
P. nitidum . .	X			X			X	
P. pulchellum . .							X	

Habitats:

1. Malham Tarn—*Chara aspera* bed in Three Trees Bay.
2. Malham Tarn—sandy bays.
3. Malham Tarn—sedge beds.
4. The Fen.
5. The outflow stream.
6. The Flush on the Tarn Moss.
7. Gordale Head.
8. Marshes.

Details of these habitats will be found in the text above.

FOOTNOTE. Malham Tarn House is now a Field Centre of the Council for the Promotion of Field Studies. In August 1955 a course on Mollusca was held there under the leadership of Dr. H. E. Quick and the author, and it was during the week of the course and the one following that most of the ecological data for this paper were collected. It is realised that a great deal has been left out, especially with regard to the commoner land species, but to have given greater details would have added considerably to its length.

Maps showing the distribution of each species, specific notes giving all records to date and lists of the species for each habitat have been deposited at the Centre. There is also a reference collection of all the shelled species and some of the slugs. Much work remains to be done, and it is hoped that the facilities offered at the Centre will encourage others to continue with it.

The author owes a great debt to Mr. P. F. Holmes, the Warden at Malham Tarn, and to Mr. C. A. Sinker, his Assistant, for their unfailing interest, advice and help. Much that is in this paper is due to Dr. Quick, but the outstanding memory is of his happy companionship. A good deal has been written on the *Pisidium* and the credit for this is due to Mr. A. E. Ellis for his determinations and to Mr. A. W. Stelfox for past records and comments; the author also thanks Mr. Percy Evans for the production of the excellent maps. Finally, a tribute is due to the sixteen enthusiastic students who worked so hard and produced so many snails. There is one query: why did it happen that the first Mollusca course at Malham should be during the driest summer for many years?

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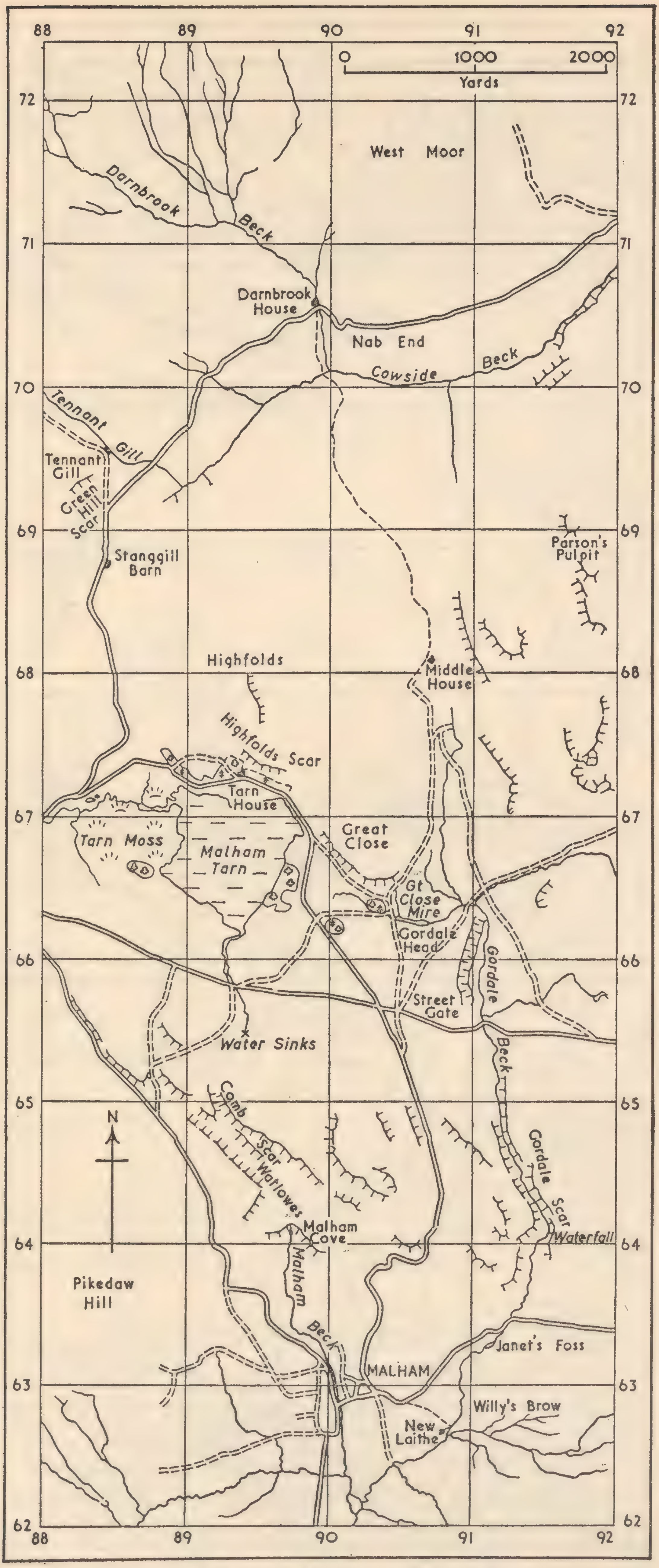

FIG. 1. MAP OF MALHAM TARN AREA.
Reproduced from the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office. Crown Copyright reserved.

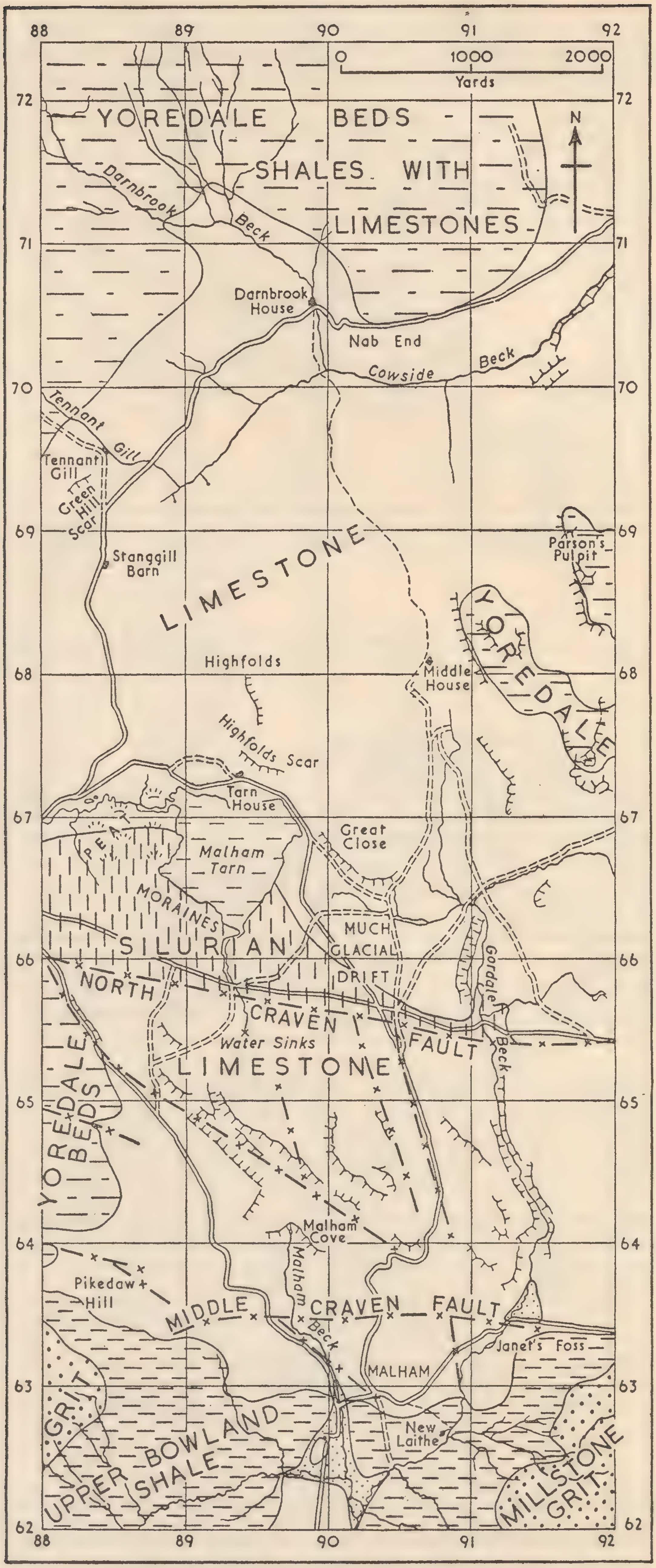

FIG. 2. GEOLOGICAL MAP OF THE MALHAM TARN AREA.
Published by permission of the Director of the Geological Survey of Great Britain.

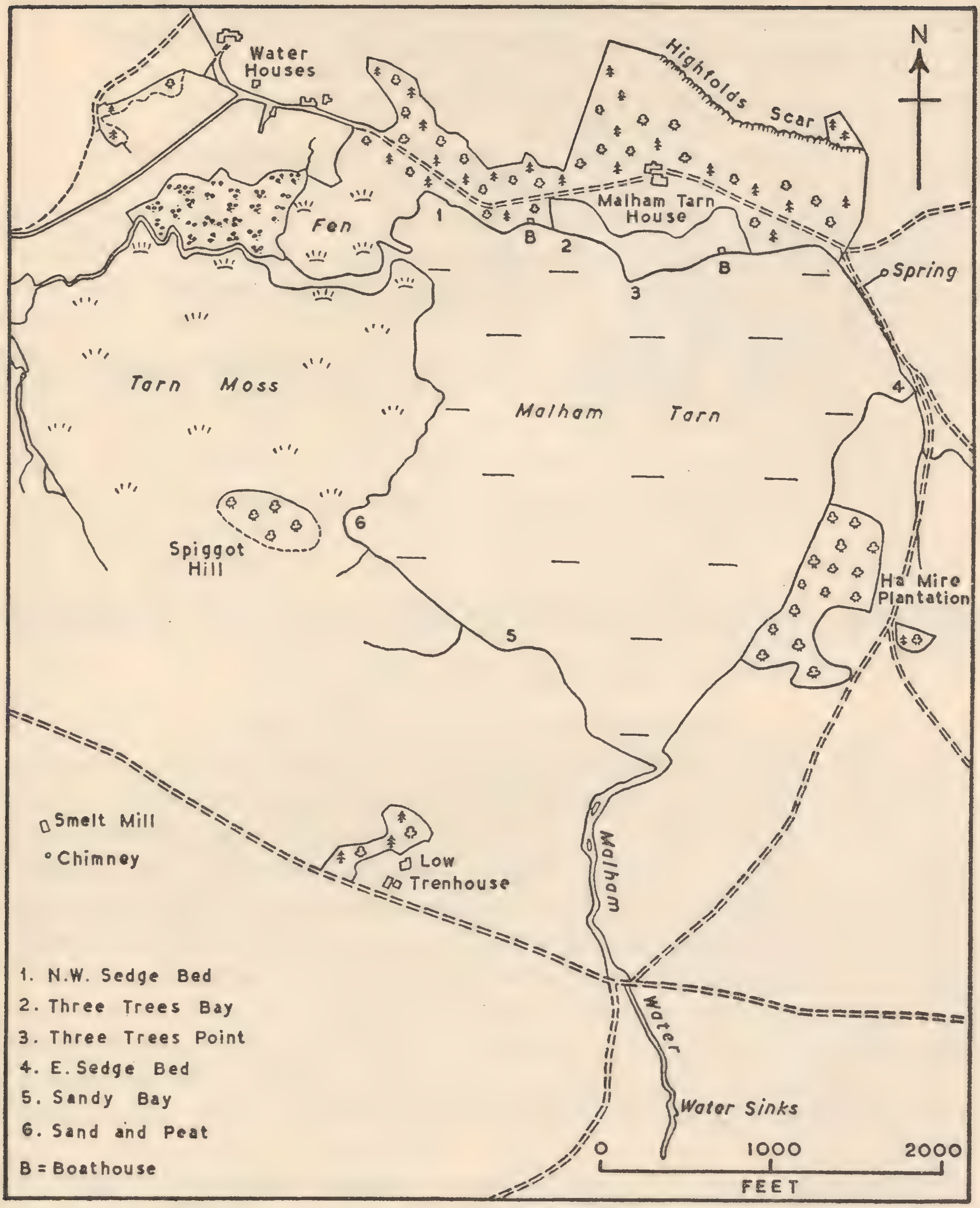

FIG. 3. MAP OF MALHAM TARN.
Reproduced from the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office. Crown Copyright reserved.

The Geological Map of the Malham Tarn area (Fig. 2) was compiled by permission from the maps by Professor Garwood and Miss Goodyear in *Q.J. Geol. Soc.*, vol. 80 (1924), Dr. R. G. S. Hudson in *Proc. Leeds Phil. Soc.*, vol. 4 (1924), and H.M. Geological Survey. The blank areas are occupied by limestone, the underlying Silurian shales are shown by vertical shading, and the over-lying Yoredale and Bowland beds by horizontal shading. The Millstone Grit outcrop is marked by large dots, and two small areas of Alluvium by closely spaced small dots. Scale one mile to an inch.

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SINISTRAL *OXYCHILUS CELLARIUS* (MÜLLER) IN SWEDEN.

By HANS SCHLESCH, D.Ph. & Sc.

(*Read before the Society*, 21 *April* 1956.)

REVERSED specimens are always attractive and deserve to be published in the literature. It is, however, interesting to observe that while in some species such abnormalities occur fairly frequently (e.g. *Helicella itala*, *Monacha cartusiana*, *Theba pisana*, *Helix nemoralis*, *H. hortensis*, *H. pomatia*, *H. aspersa*), in others they are scarce (e.g. *Cochlicopa lubrica*, *Pupilla muscorum*, *Lauria cylindracea*, *Vallonia pulchella*, *Discus rotundatus*, *Hygromia hispida*, *Arianta arbustorum*, *Helicigona lapicida*). Reversed shells are still not recorded for many species.

My friend Arvid Nilsson recently favoured me with three sinistral specimens found by him near Landskrona in western Scania, namely: *Oxychilus cellarius* (Müller), Bergkvist's greenhouse, Örja, 23 September 1955.

Arianta arbustorum (L.), Hildesborg, 25 August 1927 (at the same place Mr. Nilsson found a second specimen).

Helix hortensis Müller, Sireköpinge Park, 14 May 1955.

The only published record of sinistral *Oxychilus cellarius* appears to be that given by C. W. Johnson (*Nautilus*, Dec. 1893, p. 90), collected by R. Walton at West Conshohocken, Pennsylvania, U.S.A.

A PRELIMINARY NOTE ON THE NATURE OF CERTAIN GRANULES FROM POST-GLACIAL DEPOSITS IN THE LEA VALLEY

By John F. Hayward, Ph.D., M.Sc., F.G.S.

(*Read before the Society*, 19 *November* 1955)

Mr. S. H. Warren in his valuable analysis of deposits in the Nazeing area (*Phil. Trans. Roy. Soc.*, B, **236,** 189) referred to certain granules with which he was unfamiliar and which resembled ooliths. He had submitted these to Dr. K. P. Oakley, who in turn had asked for a mineralogical report from Dr. J. D. H. Wiseman. The reports of these collaborators were included in Mr. Warren's description.

When some of these granules, which lack the concentric growth of ooliths, were shewn to the present writer, he recognized them as the structures which are regarded by palaeontologists as the granules of Arionid slugs, though the latter are imperfectly understood. He therefore decided to investigate the matter. Some zoologists claim that they have never seen the granules of *Arion*, and in fact three out of five of these slugs (*A. ater* Linné) which the author examined were without these structures. The other two yielded them in large numbers but they were much smaller than the fossil ones.

Dr. H. E. Quick has informed the writer that in his experience *Arion hortensis* Férussac starts life with a normal plate-like internal shell but that this degenerates later in life. This fact must undoubtedly have an important bearing on the subject.

While accepting the probability that authors are correct in following Kennard in regarding many of these granules as the degenerated shells of Arionids, the writer wishes to put on record the fact that he has evidence that some are certainly from another source. Examination of material washed out from various deposits in the Lea valley, and in particular the marsh clays, has proved that the more normal types of slug shell undergo disintegration, presumably under the influence of percolating waters. All stages have been found between the unaltered plate, the eroded plate which is nevertheless identifiable, and the granule. Furthermore, the author has succeeded in causing the disintegration of the shell of a living *Milax* by placing it in a test-tube of water through which carbon dioxide was passed. It is therefore suggested that the fossil slug shells suffered erosion through the action of carbonated water or perhaps water containing " humic " acid or other organic acids.

The writer has also considered the possibility that organisms other than slugs may have secreted these granules and has not been satisfied that this could have happened. It is therefore proposed that, for the time being, it is desirable to refer to these structures as " slug granules " instead of " *Arion* granules ", and that further work should be carried out regarding the latter.

The author acknowledges with thanks the many zoologists who have discussed aspects of the matter with him.

A NEW SUBSPECIES OF *PILA AFRICANA* (MARTENS)

By L. W. A. C. Venmans

(*Read before the Society,* 19 *November* 1955)

Under No. 7010 of my collection are eighteen shells [1] of a *Pila* collected in 1950 by the Rev. Father Ch. van den Hof in some small forest rivers and creeks of stagnant water in the river basin of the Aruwimi in the neighbourhood of Kole, a small borough some 80 km. north of Banalia, in the Belgian Congo. In Kishwahili these mollusks are called " edingu " and are consumed by the natives, who regard them as a delicacy.

With a reservation as to the measurements the shells fully agree with the description and figures which Pilsbry and Bequaert (1927, 176) give of their *Pila microglypta*, of which species H. Lang found 21 examples at Stanleyville. During his visit to me Dr. J. C. Bequaert accordingly determined my specimens as belonging to this species.

In their complementary description the authors say that by size and sculpture the species appeared most nearly related to *Pila africana* (Martens, 1886) from Abetifi and Accra on the Gold Coast, from which it differs in colour, the presence of bands, and being umbilicate rather than perforate, but shade of colour in shells is always a relative peculiarity; the presence of bands in the Stanleyville specimens is not a difference at all, because von Martens says in his description of *Pila africana*: " fasciis nullis *vel obsoletis* "; and the question whether one speaks of " umbilicate " or " perforate " in shells of the *Pila*-type is very problematical, a great deal depending on whether one has to do with a fully or almost fully adult specimen.

In comparing the descriptions I came to the conclusion that *Pila microglypta* (Pilsbry and Bequaert) is a synonym of *Pila africana* (Martens). Mr. T. Pain, who was so kind as to examine my specimens, came to the same conclusion, and writes that Dr. Bequaert also agrees with him in this respect. For reasons of priority the species has to be therefore named: *Pila africana* (Martens).

Alderson (1925) makes no mention of *Pila africana*, but confused the West African species with *Pila adgusta* (Reeve) [= *Pila deckeni* (Martens)] from Zanzibar. He notes, however, that the Gold Coast shells are smaller and that they are unbanded.

Mr. Pain also drew my attention to a figure of *Pila africana,* under the name *Ampullaria pilula*, in Reeve (1856, sp. 36).

The specimens from Kole show the characteristic vertical and longitudinal minute sculpture of the species. In only one specimen, of which the inner side of the aperture is deep chestnut coloured, no bands can be seen; all the other specimens show a great number of small brownish bands and lines (up to 27), which in many of them tend to an arrangement into groups of three. In many cases the lip of the adult specimens is yellow. The upper part of the pallial wall is mostly milky white. Outwardly the younger specimens are olive coloured, the adult ones show a

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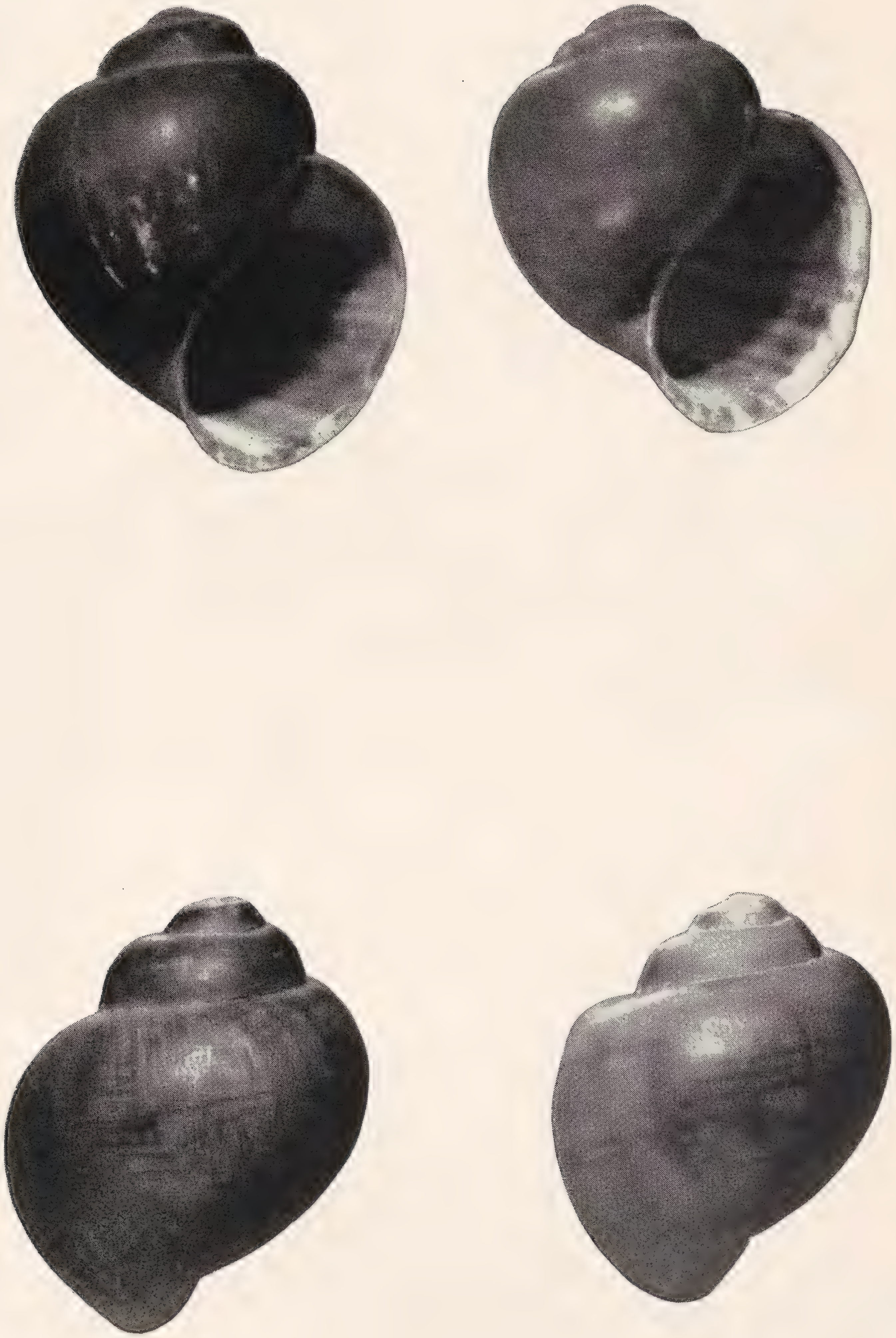
[1] Besides these 18 shells, there are also 2 specimens in the collection of Mr. T. Pain.



Pila africana koleensis. Holotype (left) and paratype.

[*To face page* 140

darker, brownish tinge. The shells have the following measurements in millimetres:

Height of shell	Maj. diam. of shell	Height of aperture	Width of aperture	Number of whorls	
56·7	46·1	38·2	24·6	4¾	Holotype
52·0	46·6	39·1	24·7	4¾	Paratypes
52·6	47·5	36·2	25·2	4¼	
52·0	45·1	37·8	25·5	4¼	coll. Pain
54·1	48·0	39·6	24·0	4¾	
54·0	45·0	39·4	25·5	4¾	coll. Pain
52·7	44·1	37·6	24·9	4¼	
47·2	39·9	33·5	22·8	4½	
49·4	42·1	36·0	23·0	4¼	
47·3	39·8	33·7	22·9	4¼	
40·6	35·2	29·0	18·3	4½	
44·7	37·7	32·0	20·4	4¼	
42·7	38·3	30·5	20·3	4¼	
39·6	33·3	28·0	17·0	4¼	
37·5	32·7	27·5	17·9	4¼	
38·6	32·9	27·7	16·5	4¼	
41·1	34·1	28·5	18·0	4¼	
38·0	32·8	26·6	17·8	4¼	
35·8	32·5	26·0	17·8	4¼	
37·0	31·4	27·5	16·5	4¼	

The exact measurements of the height of the shells and the exact number of whorls cannot be given because of the erosion of the apex of all specimens. The numbers noted here are therefore minima and show the actual size of the shells in their present condition.

In view of the very much larger average size of the specimens obtained at Kole, and since typical *africana* does not seem to occur in the Aruwimi basin, this would appear to constitute a distinct ecological race, for which I propose the name: **Pila africana koleensis** n.subsp.

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Addendum. Mr. T. Pain informs me that in his collection there are four sets of *Pila africana* :

1. Ganta, Liberia, Dr. J. C. Bequaert.
2. Adeiso near Nsawam, Gold Coast.
3. Stanleyville, Belgian Congo (Dyke).
4. Accra, Gold Coast, *ex* Alderson collection.

All his specimens are small, one from Accra being the largest (47 × 42 mm.). Only one of the Stanleyville specimens appears to be adult (37 × 37 mm.). The Liberian specimens are all about the same size and are quite bandless. The shells from Adeiso are larger, the largest measuring 45 × 41 mm.

FURTHER NOTES ON THE NON-MARINE MOLLUSCA FROM SEMI-ARID AREAS OF EAST AFRICA

By T. Pain

(*Read before the Society*, 19 *November* 1955)

Since the publication in this *Journal* (vol. 23, p. 398) of my original notes on the land and freshwater Mollusca collected in northern Kenya and Somalia by Mr. C. F. Hemming, he has made a further collection containing a number of important new records as follows. The systematic arrangement adopted here is the same as that used in my previous paper and detailed references given therein are not repeated here.

ACHATINIDAE

Achatina Lamarck, 1799

Achatina (*Lissachatina*) *fulica hamillei* Petit

Somalia: 8 miles S.E. of Afmadu (0° 23′ N, 42° 07′ E); 4 miles N. of Villagio (2° 50′ N, 45° 30′ E).

Achatina (*Lissachatina*) *fulica rodatzi* Dunker

Somalia: Beles Cogani (0° 16′ N, 41° 47′ E).

Achatina (*Lissachatina*) *lactea* Reeve

Somalia: 19 miles S.W. of Medun (1° 00′ N, 43° 45′ E); 13 miles S.W. of Medun; 8 miles N. of Mogadishu.

All the shells obtained at the above localities were dead and without trace of periostracum; several are however in a very good state of preservation. One example collected 13 miles S.W. of Medun consists of $8\frac{1}{2}$ whorls and measures: length 124, greatest width 65, aperture 59 × 34 mm. It is considerably larger than Reeve's type (length 115 mm.) and is in fact by far the largest specimen so far recorded.

Mr. Hemming (*in litt.* 1955) informs me that *A. lactea* is not a rare shell. It seems to live in a fairly restricted soil type and may in fact prove to be an ecotype. He considers that the species may be on the decline, as clearly identifiable fragments were found on the same type of soil over a large area, with no whole shells.

So far as I am aware no living examples have ever been met with or recorded.

ENIDAE

Rachis Albers, 1850

Rachis rhodotaenia (Martens)

Bulimus (*Rachis*) *rhodotaenia* Martens, 1878. *Monatsberichte der Kgl. Akademie der Wissenschaften zu Berlin*, 292, Taf. 2, fig. 7.

Kenya: 10 miles W. of Maktan (38° E, 3° 26′ N).

ARIOPHANTIDAE

Zingis Martens, 1878

Zingis (*Bloyetia*) *peliostoma* (Martens)

Trochomania peliostoma Martens, 1882. *Jahrbuch der Deutschen Malakzoologischen Gesellschaft*, **9**, 250.

Ethiopia: Ogaden; 9 miles S.W. of Wadere and at Danot and Ferfer.

AMPULLARIIDAE

Ampullaria Lamarck, 1799

Ampullaria speciosa Philippi

Somalia: 22 miles N.E. of Medun; 4 miles N. of Villagio.

Ampullaria wernei Philippi

Somalia: Beles Cogani. A small and stunted form, the first authentic record of this species from Somalia. The largest example, apparently adult, measures: length 50, greatest width 44, aperture 39×24 mm.

Kenya: Lake Rudolf, 16 miles S.W. of Ferguson's Gulf (3° 13′ N, 35° 51′ E), subfossil in clay pan. No *Ampullaria* are now known to be living in or around Lake Rudolf. This fossil occurrence points to a wetter climate in the recent past. All the examples taken were small, the largest being only 47 mm. in length.

Lanistes Montfort, 1810

Lanistes (*Lanistes*) *carinatus* (Oliver)

Ethiopia: Ogaden at Musta Hill. The first reliable record for any member of the *Ampullariidae* from Ethiopia. Somalia: Villagio. Kenya: N. Province, Garissa, in ravine forest.

THE CORYNDON MUSEUM.—The collection of East African Marine Bivalves in the Coryndon Museum, Nairobi, is entirely unnamed. Any conchologist prepared to undertake their identification is requested to communicate with B. Verdcourt, Box 5166, Nairobi, Kenya.

A NEW SPECIES OF *SYNAPTERPES* FROM COLOMBIA

By T. E. Crowley

Amongst a small collection of land shells made in Colombia by Mr. J. Brouwer, occurred a species of *Synapterpes* of the subgenus *Promoussonius* described herein. This collection passed into the hands of Mr. R. Wright Barker, who sent examples of this new species to Mr. T. Pain. Mr. Pain, being unable to identify it, submitted it to Dr. Fritz Haas of the Chicago Natural History Museum, who was of the opinion that it represented a species so far undescribed. I am indebted to Mr. Pain for the opportunity to figure and describe this species.

Synapterpes (*Promoussonius*) *propinquus*, n.sp.

Shell imperforate, subturreted, strongly striate longitudinally, and with faint transverse lines giving a reticulate effect. Suture puckered, not deep. Spire conic, slightly convex, the summit large and obtuse. Whorls 7½, slightly convex, the topmost whorl not ascending. Body-whorl long, ovate, rounded at the base, and 7-16ths the length of the shell. The colour is near to that of polished light oak, glossy; periostracum thick, liable to flaking in old shells, leaving a dull, chalky white surface. Aperture narrow above and wider at the base, set at a small angle to the axis, pale within. Peristome unexpanded, arcuate, basal margin receding, columellar margin thin. Columella pale, long, twisted, and obliquely subtruncate below. Animal unknown at present.

Measurements in millimetres:—

	Holotype	Paratype	Paratype
Length . . .	32·5	24·5	26
Max. diameter .	11·5	10	10·5
Aperture length .	13	11·5	12
Aperture width .	6·5	6	6

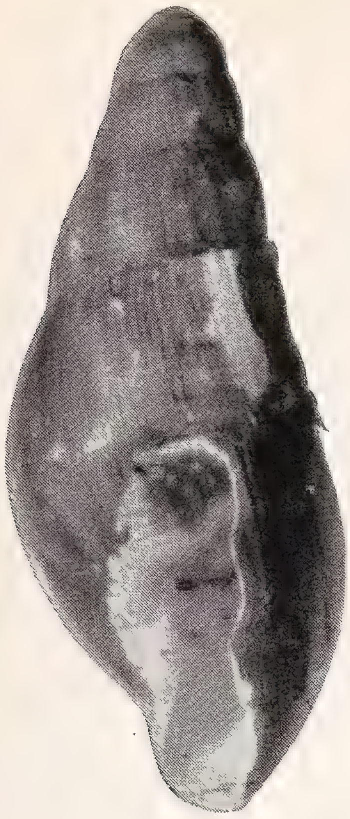
Locality: Vulcano Puraco, Colombia, high up the mountain (J. Brouwer). Holotype in the collection of Mr. T. Pain. Paratypes in the Chicago Natural History Museum (No. 52727) and in the collections of the author and of Mr. R. Wright Barker.

This new species is obviously closely related to *Synapterpes* (*Promoussonius*) *incertus* (Mousson, 1873), from Bogota, Colombia, but with half a whorl more. It is somewhat smaller, more slender, with the columella slightly more thickened. The large nepionic shell in the case of *S. propinquus* is smooth. In most details the two species agree fairly well, especially in so far as the superficial sculpture of the shell is concerned. One of the paratypes in the Chicago Natural History Museum contains globular eggs, with a hard calcified shell of a yellow colour, measuring 3·3 mm. in diameter. As in the case of *S. incertus*, indistinct spiral markings of a slightly deeper tinge can be discerned. Pilsbry (1906) describes *S. incertus* in detail and gives good figures of it.

References

Pilsbry, H. A., 1906. In Tryon, *Manual of Conchology*, 2nd series, **18,** 231, pl. 37, figs. 92–94.

Mousson, A., 1873. *Malak. Blätt.* **21,** 14.



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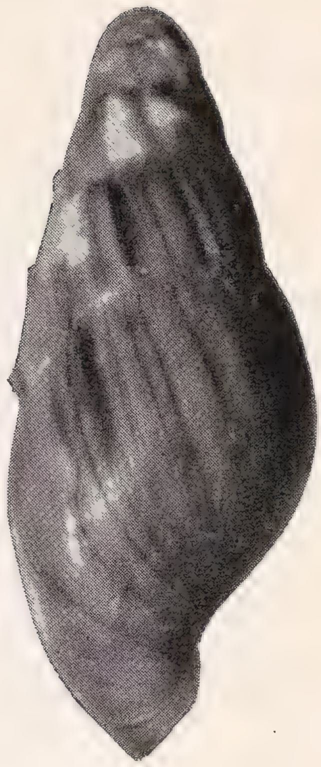

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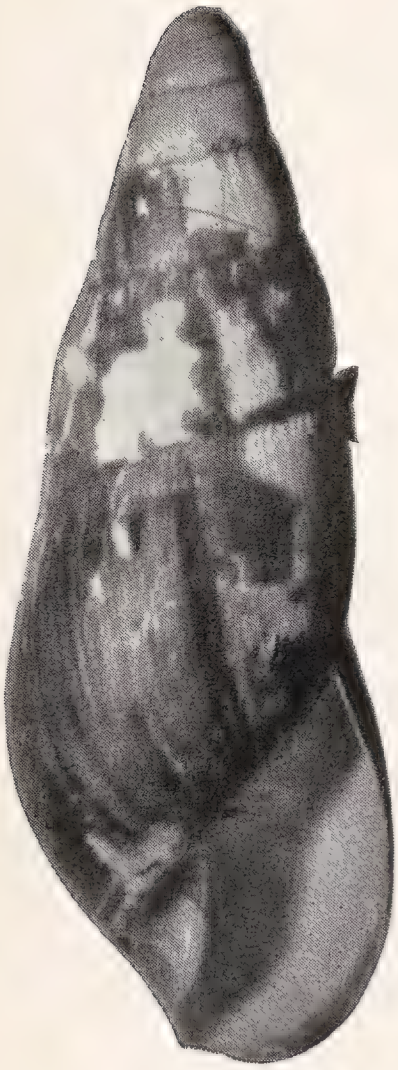

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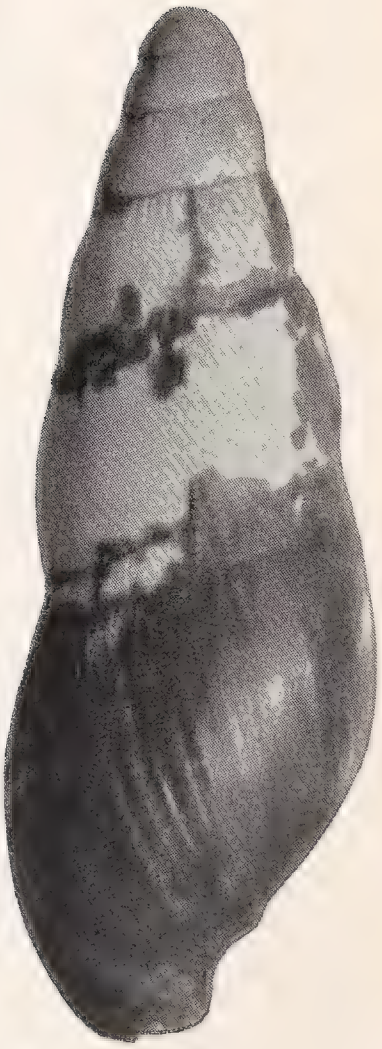

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Synapterpes promoussonius propinquus (×2).

1, 2, Paratypes. 3, 4, Holotype.

EFFECTS OF A GALE ON THE SOUTH LANCASHIRE COAST

By The Rev. Prof. L. W. Grensted, D.D.

(*Read before the Society*, 19 *November* 1955)

In the first week of October 1955 and again in the third week there were very strong inshore winds, amounting almost to north-westerly gales, along the Merseyside coast. It is not often that a very familiar shore produces a complete surprise, but I could hardly believe my eyes when I went for a short walk on the shore at Waterloo, barely two miles north of the docks at Seaforth, on 22 October. I have known the shore from there to Southport all my life, and was collecting shells there over sixty years ago. Yet on this occasion the shore was strewn with enormous numbers of shells, washed out of the sand at low tide level by the ground swell, and almost all of them were at first sight completely unknown to me. They turned out to be the young, about an inch long, of *Lutraria lutraria* (L.), a species of which there have always been a few old valves lying about, but by no means common. Of the companion species, *Mya arenaria* L., I saw only a single specimen, also about an inch long. No other species seems to have been involved in this local catastrophe, though there were a few fresh shells with them of *Donax vittatus* (da Costa), *Macoma balthica* (L.) and *Abra alba* (Wood). My surprise was in part due to the fact that the shore at that point has for many years become increasingly bare of fresh shells, owing to the fouling of the Mersey and, probably, to severe dredging in the channel. Clearly a whole bed of young *L. lutraria* was, and probably still is, in full and exuberant health. My impression is that this constitutes a real and recent change in the balance of the local marine fauna. It was striking that the shells were all beautifully clean. The gulls had not touched them, or if they had, had swallowed them whole and left no fragments.

I followed the matter up next day by visiting the far cleaner and richer shore between Freshfield and Ainsdale. The storm had left even greater numbers of shells, piled up in shallow heaps and numbering millions. In this case *Mactra corallina cinerea* (Montagu) formed the vast majority, but there were again many *L. lutraria*, with *A. alba* and, this time, many *Tellina fabula* Gmelin, the latter providing a clear indication of the source of the shells in the flat sand just below low tide mark. I have never seen these young *L. lutraria* before at any point between Liverpool and Southport.

Mrs. N. F. McMillan, to whom I wrote about this incident, informs me that Mr. A. L. Galliford reported seeing enormous quantities of shells, which she identified as *M. corallina cinerea*, piled up along the shore at Freshfield on 8 October, " stretching in both directions as far as one could see; in places the shells were three or four inches deep in lines as much as a yard wide." Similar conchological disasters along that stretch of coast have been recorded before, e.g. by Orton (1929) and Williams (1939), and I have myself seen their effects more than once, but the curious feature of this latest holocaust is the unexpected appearance of *L. lutraria* as a major component of the marine fauna.

REFERENCES

ORTON, J. H., 1929. Severe environmental mortality among *Abra* (*Syndosmya*) *alba*, *Donax vittatus*, and other organisms off the Lancashire coast. *Nature* **124**, 911.

WILLIAMS, G. E., 1939. Severe mortality of *Mactra corallina cinerea* (Montagu) off the Lancashire coast. *Nature* **144**, 1049.

ADDENDUM: As a sequel to Professor Grensted's observations, it may be noted that a similar state of affairs prevailed after the gale of 1 January 1956. On 3 January I visited the South Lancashire coast at Hall Road, and found *Mactra corallina cinerea*, all half grown or younger, cast up in great numbers, complete with the very recently dead animals. The following additional species were represented by valves only: *Cardium echinatum* L., *C. edule* L., *Donax vittatus*, *Spisula subtruncata* (da Costa), *Mya arenaria*, *Barnea candida* (L.).

N. F. MCMILLAN.

A NEW LOCALITY FOR *CYPRAEA* (*EROSARIA*) *GUTTATA* GMELIN

By PROFESSOR MASAO AZUMA

(*Read before the Society*, 19 *November* 1955)

ON 30 March 1955 a specimen of *Cypraea* (*Erosaria*) *guttata* Gmelin was found among refuse at Kochi, Tosa Bay, on the east side of Shikoku Island, Japan. A usually reliable fisherman stated that the refuse had come from his lobster fishing net, which he had operated from a trawler just outside Tosa Bay, at a depth of about 120 fathoms, between 32° and 33° N. latitude.

The shell is faded, and may have been dead when dredged. It measures 55 mm. in length, 33 mm. in breadth, and 26 mm. in height. The labial teeth number 27 and the columellar teeth 24. It is similar in shape and proportions to the specimen in the British Museum (Natural History), but is 9 mm. shorter.

Schilder & Schilder (1938, *Proc. Malac. Soc.* **23**, 139) give the range of *C. guttata* as " Central Melanesia: New Hebrides to New Britain ", and add that it is "an extremely rare species, characterized by the red-brown teeth crossing the base ". No specimen has hitherto been collected so far north as Japan, but the extreme rarity of known shells suggests that this new specimen is a genuine inhabitant of Japanese waters, and not an accidental importation. It does not appear to differ sufficiently from other specimens to merit subspecific rank.

I am indebted to Lt.-Col. R. J. Griffiths for his assistance in preparing this note.

PISIDIUM OBTUSALE LAPPONICUM CLESSIN FROM THE LOWER GRAVEL AT SWANSCOMBE, KENT.

By S. P. DANCE.

(*Read before the Society*, 21 *April* 1956.)

EARLY in 1955 Mr. A. G. Davis sent me a large quantity of fossil *Pisidium* from the Lower Gravel of Barnfield Pit at Swanscombe, Kent. The *Pisidium* fauna of this deposit is given in Mr. Davis' detailed paper on the Swanscombe complex (Davis 1953) and nine species are listed therein. Besides those listed, mention is made of a few valves of a *Pisidium* which was unfamiliar to Mr. Ellis, Mr. Stelfox and M. Favre. It was in order to obtain more examples of this " puzzling form " that I borrowed the material, but a detailed examination of the sample, numbering many hundreds of valves, proved fruitless. However, I did find eight valves belonging to two species that are not recorded by Davis and they are here placed on record.

P. obtusale lapponicum Clessin :	1 valve.
P. hibernicum Westerlund :	7 valves.

The occurrence here of *P. obtusale lapponicum* is very interesting, as this is only the fourth recorded instance of this distinct form of *P. obtusale* (Lamarck) as a fossil in the British Isles. Stelfox first found it in the late Pleistocene–early Post Glacial marls of the White Bog, Killough, Co. Down, Ireland (Ellis 1951) where he also detected *P. vincentianum* Woodward (Stelfox 1929). It has also been recorded from the Arctic or Ponders End Stage at Nazeing, Essex (Allison, Godwin and Warren 1952), and from an early Holocene tufa at Letchworth, Hertfordshire (Kerney 1955). The Swanscombe find is, therefore, the oldest yet known from the British Isles. On the Continent it is recorded from a number of localities, but the only one of comparable age is that noted by Breuil (1952) who records it, once again associated with *P. vincentianum*, from the High Terrace (30 metres) of the Somme at Thennes and there represented by one or two valves only. For the loan of specimens and for helpful advice I am indebted to Mr. A. G. Davis. Mr. A. W. Stelfox kindly examined and made notes on examples sent to him, for which I am most grateful.

REFERENCES.

ALLISON, J., GODWIN, H., and WARREN, S. H., 1952. Late Glacial deposits at Nazeing in the Lea Valley. *Phil. Trans. Roy. Soc.* B, 236, 169–240.

BREUIL, H., 1952. Glanes conchyliologiques en France (Nord et Sud Ouest) determinées par A. S. Kennard. *Congrés préhist. de France*, 13th Session, Paris 1950, 1–50.

DAVIS, A. G., 1953. On the Geological history of some of our snails, illustrated by some Pleistocene and Holocene deposits in Kent and Surrey. *J. Conchol.* **23**, 355–364.

ELLIS, A. E., 1951. Census of the distribution of British non-marine Mollusca. *J. Conchol.* **23**, 171–244.

KERNEY, M., 1955. On the former occurrence of *Vertigo parcedentata* (Al. Braun) in Hertfordshire. *J. Conchol.* **24**, 55–58.

STELFOX, A. W., 1929. Report on recent additions to the Irish fauna and flora. Mollusca. *Proc. Roy. Irish Acad.* **39**, B, 8.

REVIEW

Introducing Sea Shells. R. Tucker Abbott, M.S. Pp. vi, 64; 8 plates (4 in colour), text-figures, picture boards. D. van Nostrand Company, Inc., New York (English agents, Macmillan & Co. Ltd.), 1955. 18s.

This useful little book is a popular digest of the same author's more elaborate but equally clearly written *American Sea Shells* (1954). It touches briefly on most subjects of interest to the general marine collector, and includes sections on rare shells, precious pearls, collecting, types of shallow water dredges, economic uses of shells, preparing shells for the collection, and shells with poisonous stings (Conidae). This indicates the amount of information contained in the book, all told in the simplest language, with a studious avoidance of Latin names in the text, a shortcoming partly covered by the list of shell names included, with a list of dealers and clubs, at the end of the book. Not the least useful section is that devoted to the construction of a simple practical cabinet, with diagrams and measurements of drawers, trays and labels guaranteed to give maximum " uniformity and mobility ".

While simplicity is the keynote of this " guide for beginners to the secrets of shell collecting ", it is a pity that the author discourages the use of Latin names, for ignorance of them is bound to be a handicap when the collector wishes to widen his field and exchange with foreign correspondents. No fault, however, can be found with the beautiful colour plates and well drawn text-figures, by F. M. Bayer, which adorn the book, particularly those depicting the life histories of *Nassa* and *Yoldia*.

G. L. Wilkins.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND

743rd Meeting, held at the British Museum (Natural History), 17 December 1955

The President in the chair.

Election of Member

The Australian Museum, College Street, Sydney, N.S.W., Australia.

Communication

" Early Post-Glacial deposits in King's County, Ireland, and their Molluscan fauna," by M. P. Kerney.

Exhibits

Special exhibits: Cymatiidae and Vitrinidae.

The President: Cymatiidae from New Zealand.

Mr. C. P. Castell: Fossil Cymatiidae and recent and fossil *Vitrina* from the British Museum collections.

Mr. D. Curry: Eocene and Miocene Cymatiidae.

Lt.-Col. R. J. Griffiths: specimens of Cerithiidae.

Dr. J. F. Hayward: three specimens of *Ostrea bellovacina* in the position of life on a large Eocene pebble, from Rock Pit, Elmstead Woods, Kent.

Mr. T. Pain: a series of *Achatina reticulata*, Zanzibar, illustrating growth stages from egg to adult.

744th Meeting, held at the British Museum (Natural History) 21 January 1956

Mr. G. L. Wilkins, Vice-President, in the chair.

Election of Member

Ernest Dearing, B.Sc., 37 Ormerod Road, Burnley, Lancs.

Communications

" *Anodonta minima* Millet in Dorset," and " *A. minima* in Huntingdonshire," by A. G. Davis.

Exhibits

Special exhibits: *Architectonica*, Arcidae.

Rev. H. E. J. Biggs: *Arca* from the Persian Gulf.

Mr. C. P. Castell: Fossil *Architectonica* and Arcidae from the British Museum collections.

Mr. A. G. Davis: *A. minima* from Dorset and Hunts; a block of sandy London Clay full of *Glycymeris brevirostris* and other fossils from Nursling, Hants.

Lt.-Col. R. J. Griffiths: *Cypraea tigris* etched by acid, from Naples.

745th (Annual) Meeting, held at the British Museum (Natural History), 18 February 1956

The President in the chair.

Election of Members

I. C. J. Galbraith, M.A., British Museum (Natural History), Cromwell Road, London, S.W.7.

Dr. Vojen Ložek, Quaternary Department, Central Institute of Geology, Prague 1, Hradebni 9, Czechoslovakia.

Mrs. A. F. Mehta, B.A., P.O. Box 336, Zanzibar (B.E.A.).

Zoologisch Museum, Plantage Middenlaan 53, Amsterdam C, Holland.

Election of Scrutineers

Mrs. M. Ainsley and Mr. G. W. Pitchford were elected Scrutineers.

Election of Auditors

Miss M. Maitland Howard and Mr. G. L. Wilkins were re-elected Auditors.

Statement of Accounts

The Hon. Treasurer presented the audited accounts for 1955, which were adopted.

Annual Reports

The reports of the Council, the Yorkshire Branch and the Recorder of non-marine Mollusca were presented and adopted.

Votes of Thanks

Votes of thanks were approved to the Trustees of the British Museum (Natural History) for permitting the Society to hold meetings in the Museum, and to the Officers and Council for their work on behalf of the Society.

Presidential Address

The President delivered an address on "The Mollusca of the Malham area", illustrated by specimens, photographs and a map.

Election of Officers and Council

The Officers and Council were elected as shown on page 109.

Exhibits

Mr. J. F. M. de Bartolomé: *Helicodonta corcyrensis* and *Monacha olivieri* from Corfu.

Mr. T. E. Crowley: Eyes of Paua Shell (*Haliotis iris*) carved by Maori craftsmen for decorating wooden doorpost idols.

Mr. G. W. Pitchford: Varieties of *Helix aspersa.*

Mr. G. L. Wilkins: Shells from St. Helena collected by Col. W. H. Turton (1881–86), recently presented to the British Museum (see *Proc. Zool. Soc.* 1890, p. 247).

Report of the Council

Membership has increased by 6 during the year to a total of 188, comprising 179 ordinary members and 9 honorary members.

The society has lost one member by death, Lt. Col. C. J. F. Bensley.

Seven ordinary meetings and an annual general meeting have been held at the British Museum (Natural History) by kind permission of the Trustees. Three field meetings were also held, at Pangbourne (Berks.), Swanscombe (Kent) and Broxbourne (Herts.).

One number of the *Journal of Conchology* was issued, namely vol. 24, No. 2, 14 June 1955; the publication of vol. 24, No. 3, has been delayed by the printing trade dispute.

The Society's Census Record Books for non-marine Mollusca, other than the two in current use, have been placed on permanent loan in the Mollusca Library of the British Museum (Natural History).

Report of the Yorkshire Branch

At the January meeting Mr. J. F. M. de Bartolomé gave an address on "The land Mollusca of Madeira", illustrated with a fine selection of specimens. In February Mr. J. Armitage, deputising for a lecturer who was unable to be present, gave a talk on Corsica, its geography, flora and fauna, illustrated by lantern slides. At the meeting in March Mr. Armitage gave an address on "Mollusca at home and abroad", and at the April meeting members examined the shell collections at the Leeds City Museum. Mr. S. G. Appleyard's presidential address on "The Molluscan fauna of the Templenewsam ponds" was illustrated by photographs, charts and graphs. Field meetings were held at Malham, Lindrick Common, Ripon and Brotherton.

E. DEARING.

Recorder's Report: Non-marine Mollusca

Since the last Report (vol. 24, p. 69) the following new records have been authenticated. Specimens in the collections of Liverpool Public Museums have been kindly submitted by Mrs. N. F. McMillan.

Cornwall West (1): *Monacha cartusiana*, six very dwarf examples (diam. 7 mm.), Penzance, R. D. Darbishire coll., Liverpool Public Museums (requires confirmation).

Dorset (9): *Anodonta minima*, A. G. Davis (vol. 24, p. 99).

Sussex East (14): *Pisidium hibernicum*, Hooe, S. P. Dance.

Kent East (15): *Succinea oblonga*, Cranbrook, A. S. Kennard coll., Liverpool Public Museums.

Herts (20): *Retinella petronella*, Holocene, Wilstone, M. P. Kerney; *Succinea oblonga*, Holocene (vol. 24, p. 57); *Cochlicopa lubricella*, Widford, *Ena montana* (vol. 24, p. 102), L. Lloyd-Evans.

Berks (22): *Vallonia pulchella*, Pangbourne; *Pisidium obtusale*, near Reading, D. S. Tucker, Maidenhead, S. P. Dance.

Oxford (23): *Arion rufus*, Coombe End, H. E. Quick.

Bucks (24): *Carychium tridentatum*, *Vallonia pulchella*, Marlow, S. P. Dance; *Hygromia liberta*, Denham, T. E. Crowley.

Hunts (31): *Anodonta minima*, R. Nene, Stibbington, J. L. Gilbert.

Merioneth (48): *Acroloxus lacustris* (vol. 24, p. 104), L. Lloyd-Evans: the highest altitude for this species in British Isles (1,350 ft.).

Nottingham (56): *Acme fusca*, Barrows Plantation, Southwell; *Vertigo genesii*, Holocene, Southwell, G. W. Pitchford.

Chester (58): *Pyramidula rupestris*, Helbre Island, J. Ray Hardy, Liverpool Public Museums; *Oxychilus draparnaudi*, Moorside, near Parkgate, and Nantwich, Mrs. N. F. McMillan.

Lancaster South (59): *Agriolimax caruanae*, Liverpool, Mrs. N. F. McMillan.

Lancaster West (60): *Testacella scutulum*, Scorton, J. W. Jackson coll., Liverpool Public Museums.

York Mid-West (64): *Carychium minimum*, *C. tridentatum*, *Cochlicopa lubricella*, *Vallonia pulchella*, *Arion ater*, *Hygromia liberta*, *Pisidium pulchellum*, H. E. Quick and L. W. Stratton.

Dumfries (72): *Ena obscura*, *Helicella virgata*, *Cochlicella acuta*, Liverpool Public Museums.

Lanark (77): *Planorbis planorbis*, Westerhouse quarry pool, Baillieston; *P. carinatus*, Monkland canal, W. Russell Hunter.

Dunbarton (99): *Pisidium henslowanum*, Loch Lomond, W. Russell Hunter.

North Ebudes (104): *Planorbis leucostoma*, *Pisidium nitidum*, Loch Cill Chrisosd, Skye; *Pyramidula rupestris*, Suardal, Strath, Skye, W. Russell Hunter.

Sutherland West (108): *Planorbis vortex* (vol. 23, p. 418) is an error for *P. leucostoma.*

King's County (131): *Carychium minimum*, *C. tridentatum*, *Succinea oblonga*, *Zonitoides excavatus*, *Pisidium personatum*, Holocene, M. P. Kerney.

Kerry North (148N): *Acroloxus lacustris*, Killarney, George Ray Hardy, Liverpool Public Museums.

Kerry South (148S): *Succinea oblonga*, R. Roughty, Kenmare, R. Standen, 1898, Liverpool Public Museums.

A. E. E.

746th Meeting, held at the British Museum (Natural History), 17 March 1956.

Mr. A. E. Ellis, Vice-president, in the chair.

Members Elected

Leslie Seymour Atkins, B.A., B.Sc., Andreas, Rosebank Park, Douglas Road, Cork, Ireland.

Robert J. Cousins, Little Courts, Banwell, Weston-super-mare, Somerset.

Communications

" Mollusca from limestone in Skye, with special reference to *Pyramidula rupestris* (Draparnaud)," by Dr. W. Russell Hunter.

" *Pomacea* of the Sierra de Merida, Venezuela," by T. Pain.

Exhibits

Special exhibit : Similarity in unrelated species. Examples were shown by Mr. T. Pain, and from the British Museum collections by Mr. C. P. Castell and Mr. G. L. Wilkins.

Lieut.-Col. R. J. Griffiths : *Cypraea spurca* L. ; adults and embryos of *Marginella quinqueplicata* from Malaya.

Dr. H. E. Quick : Land shells from Majorca.

747th Meeting, held at the British Museum (Natural History), 21 April 1956.

Mr. A. G. Davis, Vice-president, in the chair.

Communications.

" Sinistral *Oxychilus cellarius* in Scania, Sweden," by H. Schlesch.

" *Pisidium obtusale lapponicum* Clessin from the Lower Gravel at Swanscombe, Kent," by S. P. Dance.

Exhibits.

Special exhibits : Trochidae and *Spondylus*.

Mr. G. A. S. Barnacle : *Hygromia limbata* and *H. cinctella* from Anstey's Cove, Torquay, S. Devon.

Rev. H. E. J. Biggs : *Gibbula umbilicata* and *G. pennanti* from Dinard Bay, Brittany.

Mr. C. P. Castell : Fossil Trochidae and *Spondylus* from the British Museum collections.

Mr. T. E. Crowley : *Spondylus aurantia* and *S. princeps*.

Mr. L. W. Stratton : Type species of genera of Recent Trochidae ; British Trochidae ; *Voluta hunteri* and *V. magnifica* from Tweed Heads, Queensland.

Mr. G. L. Wilkins : A series of *Spondylus varius* showing stages of growth.

ACCOUNTS FOR THE YEAR ENDING 31 DECEMBER 1955.

Income and Expenditure Account.

Dr.

	£	s.	d.	£	s.	d.
To Annual Subscriptions—						
,, Paid in 1954	1	1	0			
,, For 1955	84	10	0			
,, Arrears	5	0	0	90	11	0
,, Sales				122	0	2
,, Transfer from Life Membership Fund				20	8	0
,, Donation				1	1	0
,, Dividends				29	1	5
				£263	1	7

Cr.

	£	s.	d.	£	s.	d.
By Publication and Distribution—						
Vol. 24, part 1 . .	70	15	5			
Author's reprints . . .	9	14	0	80	9	5
Vol. 24, part 2 . . .	110	13	11			
Author's reprints . .	12	0	6	122	14	5
,, Dispatch of Parts . . .				1	8	9
,, Refund on cancelled order .					19	0
,, Printing and Stationery . .				11	10	4
,, Zoological Society . .				2	0	0
,, Zoological Record . .					8	0
,, Officers' Expenses . . .				6	3	8
,, Balance being excess of Income over Expenditure . .				37	8	0
				£263	1	7

Life Membership Fund.

	£	s.	d.
To Amount of Fund, 1 January 1955 . .	549	14	0
,, Dividends and Interest	20	8	0
	£570	2	0

	£	s.	d.
By transfer to Income and Expenditure Account	20	8	0
,, Amount of Fund, 31 December 1955 . .	549	14	0
	£570	2	0

Research and Reserve Fund.

	£	s.	d.		£	s.	d.
To Amount of Fund, 1 January 1955	391	4	8	By Amount of Fund, 31 December 1955	405	4	11
„ Dividends and Interest	14	0	3				
	£405	4	11		£405	4	11

BALANCE SHEET.

LIABILITIES.	£	s.	d.	£	s.	d.
Annual Subscriptions in advance				2	0	0
Life Membership Fund				549	14	0
Research and Reserve Fund				405	4	11
Capital Stock				800	0	0
Balance from Income and Expenditure Account—						
As on 1 January 1955	319	13	7			
For 1955	37	8	0	357	1	7
				£2,114	0	6

ASSETS.	£	s.	d.	£	s.	d.
4% Funding Loan (cost)	350	0	0			
2½% Defence Bonds (cost)	200	0	0			
3½% War Loan (cost)	40	0	0			
3½% Defence Bonds (cost)	800	0	0	1,390	0	0
Cash at Bankers—						
National Provincial Bank	224	12	4			
Post Office Savings Bank	494	8	2			
Cash in hand	5	0	0	724	0	6
				£2,114	0	6

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Examined and found correct.
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11 February 1956.

ALBERT E. SALISBURY,
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CONTENTS.

PAGE

Early Post-Glacial deposits in King's County, Ireland, and their molluscan fauna—M. P. KERNEY 155

The molluscan fauna of some early Post-Glacial deposits in North Lincolnshire and Kent—J. P. T. BURCHELL and A. G. DAVIS 164

Mollusca from limestone in Skye, with special reference to *Pyramidula rupestris* (Draparnaud)—W. RUSSELL HUNTER . 171

Pinna fragilis in Orkney—R. RENDALL 174

Nucella lapillus (L.) with double operculum—H. E. J. BIGGS . 174

Pomacea of the Sierra de Merida, Venezuela—T. PAIN . . 175

Notes on *Hygromia cinctella* (Draparnaud)—H. E. J. BIGGS . 177

Eubranchus tricolor tricolor Forbes in Orkney—R. RENDALL . 178

The radula of "*Latiaxis*" *fritschi*, and description of a new Fossarid—K. H. BARNARD 180

Reviews 181

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THE

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EARLY POST-GLACIAL DEPOSITS IN KING'S COUNTY, IRELAND, AND THEIR MOLLUSCAN FAUNA

By M. P. KERNEY

(*Read before the Society*, 17 *December* 1955)

THE localities described in this paper lie close together in the south-western part of King's County (Offaly), near the Tipperary border. The deposit at Golden Grove was discovered by the late Mr. Henry Pim of Fancraft, who in 1921 forwarded a small sample of white marl to Mr. A. W. Stelfox for examination. From it Mr. Stelfox obtained an example of *Vertigo genesii* Gredler, a new record for Ireland, as well as a molluscan fauna of a remarkable kind. The interest of this discovery prompted further field-work by Mr. Stelfox, Mr. Pim and the late R. A. Phillips, with the result that other beds of a similar nature were soon found in the vicinity. In 1925 an outline account was published in this *Journal*, together with an announcement of the discovery of living *V. genesii* at Mountmellick, Queen's County (Stelfox and Phillips, 1925).

In the summer of 1954 the writer examined the deposits that were still exposed and made fresh collections. To prevent carrying away bulky samples, much of the washing was done on the spot and by this means large series of shells were obtained. The molluscan faunas of these early post-Glacial marls and tufas are the richest ever described from the Irish Quaternary, comprising no fewer than 61 species, and in view of their interest an attempt is here made to give a full account of these faunas and of the deposits which have yielded them.

I should like to thank all those who have helped me with this paper. Mr. A. G. Davis, Dr. H. E. Quick, Dr. Hans Schlesch (Denmark) and Dr. O. Kraus (Frankfurt) gave advice or examined critical Mollusca; Mr. G. F. Mitchell (Dublin) reported on the pollen contained in a sample from Gloster; Mr. D. E. Kimmins examined caddis cases; Mr. Bryan Eccleston accompanied me in the field and shared in the collecting and to him my most grateful thanks are due. Above all, Mr. A. W. Stelfox has been an unfailing source of information and help and very kindly placed in my keeping all his material from the various sites. The determinations of *Pisidium* are entirely his. Mr. Stelfox critically read through the MS. of this paper and made a number of suggestions which I have adopted.

DESCRIPTION OF SECTIONS

A. MILLPARK.

Millpark House lies 1½ miles north-west of the town of Roscrea, North Tipperary, in a hollow between the glacial moraines which everywhere dominate the landscape. The moraines are chiefly composed of angular debris from the Carboniferous Limestone which underlies the whole area and the soil is highly calcareous. At Millpark a stream, the Ash Brook, which locally forms the Tipperary–King's County boundary, has cut its valley both through the material left by the ice-sheet and through the deposit described below, and is presumably of post-Glacial origin. On the Old Series one inch geological map (sheet 126) the word "marl" appears at this point, and a brief reference to the presence here of "white shell marl" occurs in the accompanying Memoir (1862, p. 21).

In the stream banks, immediately south-west of the Roscrea road, up to 10 feet of pure white tufa is visible. This is generally very soft and homogeneous in texture, but much is nodular or granular and marly seams are not infrequent, the latter having a bluish-grey tinge and containing a little argillaceous sediment. The base is nowhere exposed. As Mr. Stelfox suggests (1925, p. 238), this is probably a lake deposit, the tufa having been precipitated during a warm period from the lime-saturated waters of a shallow mere lying between the moraines. The freshwater Mollusca lived in the lake, while the abundant land shells were washed in at times of heavy rainfall or flooding, partly from its marshy borders and partly from wooded hillsides above. In all, 58 species are known, including the only confirmed record for Ireland of *Vertigo alpestris* Alder.

A characteristic feature of all the washings from Millpark is the presence of numerous minute curved *Dentalium*-like tubes, formed entirely of calcareous material, and belonging to a caddis-fly larva. They average about 3·5 mm. in length, and taper from about 0·5 mm. at the wider end, which may be very slightly expanded, to 0·2 mm. or less at the narrower end. Both ends are open. No larger examples, whole or fragmentary, were found, showing that we are not dealing with juveniles.

These tubes were examined by Mr. D. E. Kimmins of the British Museum (Dept. of Entomology), who stated that while he had no doubt as to their nature, he was surprised at their smallness; unfortunately caddis-cases cannot be named in default of their occupants.

The next two sites to be described, Golden Grove and Fancraft, also lie in the valley of the Ash Brook, but further upstream.

B. GOLDEN GROVE.

Golden Grove is a large estate about 1¾ miles N.N.W. of Roscrea. No exposures are now visible, but in 1924 Mr. Stelfox was able to examine and collect from sections in the sides of land-drains, which revealed rapid alternations of peats and "white marls" to a total depth of about eight feet. In places lenticles of marl occurred up to one foot thick and completely surrounded by peat on all sides. It seems likely that such lenticles did not form in situ, but represent material swept from higher ground into hollows in the surface of a bog by flooding, and later covered over by a further accumulation of peat, and they were said to contain much " interrelated peat and other vegetable refuse ". Possibly their fauna is a mixture, many of the fresh-water shells present being derived from a true Chara marl of much earlier date. A list, which embodies the results of Mr. Pim's and Mr. Stelfox's collecting, is given below under the heading " Golden Grove, marls in peat ". Samples were taken from several places and levels, but the assemblages are very similar and for the purposes of this paper they have been combined.

Between these sections and the stream to the south a cutting had been made exposing " a deep bed of marl, which is older than the peat " (Stelfox, 1925, p. 238). The assemblage here differs somewhat, for woodland species such as *Acicula fusca*, *Lauria anglica* and *Acanthinula lamellata* predominate. *Vertigo genesii* is absent. Although inferior in numbers, and fresh-water Mollusca are rare, there is a resemblance to the fauna of the Millpark tufa, and the deposit may be an upstream continuation of the same bed. Some of the shells in fact still bear a tufaceous incrustation. Those collected by Mr. Stelfox in March 1924 are listed below under the heading " Golden Grove, lower marl ".

C. FANCRAFT.

The beds here were exposed in the side of a millrace connected with the Fancraft water-mill, two miles due north of Roscrea. No section exists to-day and in August 1954 we could not find the deposits. The following sequence was noted by Mr. Stelfox in 1924 :

Fancraft millrace section.

3. Light porous surface soil	1 to 2 feet
2. White marl with a mainly terrestrial fauna 1. Bluish marly gravel with many fresh-water shells. *Vertigo genesii* present. Base not exposed.	about 1 foot

Bed (1) consisted of redeposited morainic material, and probably forms a floor to the valley. It may well be older than any of the deposits hitherto described.

Nothing can now be said as to the nature of bed (2), except that it was probably not a Chara marl, and only a small series of shells was examined. The fauna has a more terrestrial aspect than that of the gravel, and the woodland form *Acanthinula lamellata* makes its appearance.

D. GLOSTER.

The Gloster estate lies about five miles north-west of Roscrea by the road to Birr. Above this road, on the north-eastern side of the alluvial flat of the Little Brosna River, and a little south of the estate, a spring breaks out of the hillside and gives rise to a small stream. In the marshy area around the spring-head extensive beds of tufa have been laid down, which at present are being eroded. In the banks of the stream may be seen alternations of pure white tufa and dark, sometimes almost black, peaty calcareous marl. Mollusca are extremely abundant, particularly in the darker layers. This deposit is briefly referred to in the Geological Survey Memoir to the area (1862, p. 21) as follows: "a patch of marly tufa lies upon the sloping surface of the drift beside the road to Parsonstown [Birr], at some fifteen feet above the level of the neighbouring flat."

A pollen analysis upon a sample of the peaty marl was kindly carried out by Mr. G. F. Mitchell, who gave the percentages of tree pollen as follows: alder 12%; birch 6%; elm 12%; hazel 63%; oak 3%; pine 4%. Mr. Mitchell reported that "Such a count must be later than the Boreal period, but is earlier than the first arrival of Neolithic farmers in Ireland. I think that this sample may be safely assigned to the Atlantic period". He adds however that this dating should not be taken as final, since one count only was made and the pollen was poorly preserved.

Marshy conditions are indicated by *Lymnaea truncatula*, *L. palustris*, *Planorbis leucostoma* and *Pisidium casertanum*, but species characteristic of running water are quite absent. *Succinea oblonga* is abundant and *Vertigo genesii* fairly common. *Acanthinula lamellata* points to the existence of woodland, though the area is now quite bare and open. A noteworthy record, commented on below, is that of *Zonitoides excavatus*.

A remarkable feature of the Millpark and Gloster sites is the presence of extensive beds of calcareous tufa or travertine, such as are nowhere being formed in the British Isles to-day. At Millpark a thickness of twelve feet was proved without the bottom being reached, and laterally the deposit here must cover several acres. The tufas at Caerwys (Flint) and at Blashenwell (Dorset) are of similar proportions. Opinions as to the ideal conditions under which beds such as these were formed have varied (Bury, 1950, pp. 50–1), but all writers agree on the necessity for rapid evaporation of lime-charged waters induced by relatively high temperatures. Mosses and green and blue-green algae, by abstracting carbon dioxide from the water during photosynthesis, reduce the soluble bicarbonate of lime to the insoluble carbonate, and may thus become important, though probably subsidiary, factors.

The tufas of King's County may be pictured as forming by the evaporation of water from swampy areas supplied by springs, or from shallow, rush-bordered lakes, during a warm phase of the early Holocene. Land Mollusca representing many habitats abound, partly swept in by the rains, in great contrast to the Chara marls in which they are always rare or absent. That the climate was both damp and genial is shown by the richness and nature of the molluscan faunas. Deciduous woodlands mantled the slopes, and by their destruction through an excessive rainfall, probably late in the period, allowed the formation of peat beds, such as those seen at Golden Grove.

These deposits differ in origin and date from the Chara marls, or "shell marls", which underlie many of the great peat-bogs of the Central Plain. The Chara marls formed in the cool waters of extensive meres and span the period from the Late Glacial *Salix herbacea* phase to the Pre-Boreal (Charlesworth, 1953, p. 248). Their molluscan faunas are poor, the species few in number, and usually restricted to hardy fresh-water forms (Kennard and Woodward, 1917). *Planorbis laevis* is often common and very characteristic of the basal marls, and it is noteworthy that this shell does not figure in the list given below.

LIST OF MOLLUSCA.

LIST OF MOLLUSCA, HOLOCENE, KING'S COUNTY	Millpark	Golden Grove : Lower Marl	Golden Grove : Marls in Peat	Fancraft : Bed (1)	Fancraft : Bed (2)	Gloster
Valvata piscinalis (Müller)	A			9		
Acicula fusca (Montagu)	83	9		3	2	C
Bithynia tentaculata (Linné)	8		92			
Carychium minimum Müller	A	9	1	3	10	A
,, *tridentatum* (Risso)	A	31		3	12	C
Lymnaea truncatula (Müller)	C	22	4	17	11	C
,, *palustris* (Müller)	18	13	32	38		2
,, *stagnalis* (Linné)	3					
,, *peregra* (Müller)	C	1	68	5		
Physa fontinalis (Linné)	40					
Planorbis leucostoma Millet	19	10		5	1	1
,, *albus* Müller	2					
,, *crista* (Linné)	22		37	4		
,, *contortus* (Linné)	52		9			
Ancylus fluviatilis Müller	1					
Succinea oblonga Draparnaud	2		2			A
,, *pfeifferi* Rossmässler	29	6	33	28	2	80
Cochlicopa lubrica (Müller)	C	11	11	17	5	A
,, *lubricella* (Porro)	74					49
Columella edentula (Draparnaud)	53	4	4	1	2	C
Vertigo pusilla Müller	C					
,, *antivertigo* (Draparnaud)	56	18	25	12	1	61
,, *substriata* (Jeffreys)	68	10	1	2	2	C
,, *pygmaea* (Draparnaud)	52	1		4	1	5
,, *genesii* Gredler			10	2		20
,, *moulinsiana* (Dupuy)	6		1			2
,, *alpestris* Alder	19					
,, *angustior* Jeffreys	C					2
Lauria cylindracea (da Costa)	72					
,, *anglica* (Wood)	77	51	10	10	22	C
Acanthinula aculeata (Müller)	C	2		3	2	21
,, *lamellata* (Jeffreys)	42	24			6	51
Vallonia costata (Müller)	C					4
,, *pulchella* (Müller)	34	13		5		12
,, *excentrica* Sterki	50					
Ena obscura (Müller)	1					
Clausilia bidentata (Ström)	84	2			3	2
Balea perversa (Linné)	28					
Cecilioides acicula (Müller)	21					
Helix nemoralis Linné	12	X	X	X	X	X
Hygromia hispida (Linné)	C	14		6	9	91
Punctum pygmaeum (Draparnaud)	C	7	4	3	2	C
Discus rotundatus (Müller)	C	36		8	13	C

List of Mollusca, Holocene, King's County	Millpark	Golden Grove : Lower Marl	Golden Grove : Marls in Peat	Fancraft : Bed (1)	Fancraft : Bed (2)	Gloster
Arion sp.	C	1		3	8	62
Euconulus fulvus (Müller)	C	19	10	4	3	C
Vitrea crystallina (Müller)	C	15	2	14	3	A
Oxychilus cellarius (Müller)	32			3	2	
,, *alliarius* (Müller)	24					C
Retinella radiatula (Alder)	40	9	7	4		A
,, *pura* (Alder)	42	1		3	4	47
,, *nitidula* (Draparnaud)	74	1	2		11	95
Zonitoides excavatus (Alder)						37
,, *nitidus* (Müller)	C	2	5	1		9
Vitrina pellucida (Müller)	4					
" *Limax* " sp.	18	5	13	8		21
Sphaerium corneum (Linné)			15			
Pisidium casertanum (Poli)	7	C	1	29	7	6
,, *personatum* Malm	3	C		10	40	
,, *milium* Held	8		5	18	2	
,, *subtruncatum* Malm	54		5	5		
,, *nitidum* Jenyns	13		C	C	8	

C = common (100–500 examples).
A = abundant (more than 500 examples).
X = fragments only.

N.B.—The numerals indicate only the relative frequency of species at any one horizon. Since the collections from the various sites differ greatly in size, direct comparison between columns is not possible.

Notes on Certain Species

Valvata piscinalis.—The specimens from Millpark and Fancraft belong to the small, high-spired var. *alpestris* Blauner, which is said to be the prevailing form in Ireland (Kennard and Woodward, 1917, p. 180).

Acicula fusca.—This species is not known living in King's County, but it is widely distributed in Ireland, and has almost certainly been overlooked.

Lymnaea truncatula.—Only the small western race is present, never exceeding 7 mm. in height.

Succinea oblonga.—A species which is very probably a glacial relict, and is abundant in Pleistocene loessic deposits in England. Like the last, all specimens belong to a small form, averaging about 6 mm. The determination was checked by Dr. H. E. Quick. *S. oblonga* is not known with certainty living in King's County.

(*Pyramidula rupestris.*—In his 1925 report Mr. Stelfox recorded *P. rupestris* from the Gloster tufa, but no specimen can now be found amongst his shells from this site, nor were any taken by me in 1954. Mr. Stelfox has therefore requested me to omit this species from the list. It is possible that a large *Punctum pygmaeum* present in the collection may have been mistaken for a young *P. rupestris*, or the shell may have been found by the late R. A. Phillips, who several times later than 1924 visited the site, and may be in his collection. After his death Phillips' collection passed into the keeping of the National Museum of Ireland, but owing to shortage of staff in that institution it has never been arranged and is therefore not readily available for inspection.)

Vertigo pusilla and *V. angustior*.—Both species are now rare in Ireland and their known habitats are mainly coastal. That they were once more widespread is shown by their presence in great numbers in many Holocene sand-dune deposits, particularly on the west coast. The reasons for their gradual extinction, which has also taken place in England, are quite unknown, but may be connected with a decreased rainfall.

Vertigo genesii Gredler, 1856 (? = *V. parcedentata* Al. Braun, 1847).—The form present in these deposits is identical with the recent Irish species which, since its discovery by R. A. Phillips in 1924, has always been known as *Vertigo genesii* Gredler. Kennard, however, (Kennard and Musham, 1937, p. 278) referred the shells from Gloster and certain of those from Fancraft to *V. concinna* Scott, and in the Census of distribution (Ellis, 1951, p. 230) they are recorded under the name *V. parcedentata*. The specimens which Kennard saw have recently been re-examined by Dr. Hans Schlesch and Dr. O. Kraus, who consider them to be true *V. genesii*, and further examples collected by the writer compare closely.

Much doubt exists as to whether *V. genesii* and *V. parcedentata* are separate species, or forms of a single species for which the correct name would be *V. parcedentata* ; *genesii* is provisionally used in this paper as the fossils are clearly similar to the modern Irish form, known by that name, and furthermore because they belong to Gredler's barrel-shaped, somewhat tumid type, with a deep suture (Gredler, 1856, p. 122 and fig. 3). The number of denticles varies from four to none. Good drawings of shells from Fancraft and Golden Grove have been published (Stelfox and Phillips, 1925, p. 238, figs. 1, 3). The species probably still lives over a wide area of the Central Plain, and an account of its ecology has been given by Phillips (1935).

Vertigo moulinsiana.—Unknown as a fossil elsewhere in Ireland, and not found in King's County to-day, but lives a mile or two to the south near Roscrea, North Tipperary (Phillips, 1935, p. 143).

Vertigo alpestris.—The discovery of 19 examples of this shell in the Millpark tufa constitutes the first confirmed record for Ireland, since previous records for Derry, Antrim and West Donegal have been shown to be erroneous (Stelfox, 1929). *V. alpestris* has a Holarctic range and its former occurrence in Ireland is not unexpected. The Continental distribution is principally northern and alpine, and although the species does not itself indicate cold conditions, it may in many areas be a glacial relict, paralleled by the local survival of " arctic " plants. In Britain the Holocene history of *V. alpestris* points to a northward retreat.

Acanthinula lamellata.—A species of old woodland, which occurs plentifully in the tufas, always associated with *Acicula fusca* and *Lauria anglica.* Though still widespread, it is local, particularly on the Central Plain, where there is now little cover. It is also known fossil in a dune deposit, probably of no great age, at Narin, West Donegal (Kennard and Woodward, 1917, p. 130). In Britain it is certainly less common than formerly, and is almost extinct in the southern and eastern counties.

Ena obscura.—The single specimen from Millpark was found by R. A. Phillips, and is probably in his collection, now in the National Museum, Dublin.

Hygromia hispida.—The Millpark examples are of a large flat type, with a widely open umbilicus (= *Helix concinna* Jeffreys), and some attain a diameter of 10 mm. The shells from Gloster are more contracted, higher-spired and smaller, never exceeding 7·5 mm.

Vitrea crystallina.—All the specimens compare closely with the form *V. contracta* (Westerlund).

Zonitoides excavatus.—This species has never before been found fossil in Ireland, and is not known at present to live in King's County. It is now a rare species over the greater part of the Central Plain and is only found there in a few very ancient and native woods. Being said to be intolerant of lime, its presence in such a highly calcareous area is very surprising. It may be that *Z. excavatus* lived on the acid, peat-covered ridge to the east of the Gloster site (if indeed the peat then existed), and that after death empty shells were washed down the hillside and incorporated in the tufa ; this is supported by the fact that the species was found only in the more peaty beds. On the other hand it has recently been recorded from a tufa at Blashenwell, Dorset, where no such explanation appears to hold (Bury, 1950).

Pisidium spp.—Nearly all are thin-shelled with weak hinges, making determination difficult. Mr. Stelfox writes concerning the series from Fancraft that " all represent very starved forms, but there is no sign of an arctic climate. I can only suggest lack of food ".

Conclusions.

The faunas described above are sufficiently complete to provide an accurate picture of the climate. Except for bed (1) at Fancraft, which may be earlier, the various marls and tufas are probably more or less contemporary and fall within a single climatic phase. Such variations as occur are due either to the vagaries of collecting, for much larger series of shells were examined from some sites than from others, or to differences in the mode of formation and in the nature of the surroundings. At Millpark we have a lake deposit yielding many fresh-water shells, whereas the tufa at Gloster formed on a marshy hillside and contains few truly aquatic Mollusca. In all many habitats are represented : clear running water, reedy swamp, damp grassland and deciduous woodland.

A heavy, but not excessive, rainfall is indicated, with higher and more equable annual temperatures. Winters were mild. With the exception of dry-loving forms, which are significantly absent, land snails flourished, and are well developed and represented by numerous species and individuals. The evidence suggests that the deposits date from the Atlantic period (c. 5000–2500 B.C.), when, from palaeobotanical evidence, such conditions are known to have been widespread in the British Isles. The pollen analysis carried out on a sample from Gloster supports this dating.

The assemblages show certain differences when compared with the present fauna of King's County. Species which are now rare or absent on the Central Plain, such as *Acicula fusca*, *Succinea oblonga*, *Vertigo pusilla*, *V. angustior* and *Acanthinula lamellata*, were then common. As in England, this retreat is probably in the main due to progressively increasing human interference since Neolithic times coupled with a decreased rainfall, with a consequent reduction of favourable habitats. On the other hand the effect of competition between species may have been important and is more difficult to assess. It may be, for example, that *Zonitoides excavatus* has taken to living in non-calcareous areas only in quite recent times, having been driven from favourable limestone tracts such as the Central Plain of Ireland by pressure from more successful members of the *Zonitidae*, but of this there is little proof and Boycott always denied the effectiveness of intra-specific competition among land-snails. In the case of *Z. excavatus*, Mr. Stelfox suggests that destruction of the oak woods may have been a factor.

Conversely, several forms now common in the area do not occur in these deposits ; notably *Helix aspersa*, *Helicella caperata*, *H. itala* and *Cochlicella acuta*. In early post-Glacial times the last three species were probably restricted to the open coastal plains and sand-hills, whence they spread inland at the oncoming of drier conditions and the destruction of the forests. The status of *Helix aspersa* in Ireland is rather doubtful. Its range has been greatly extended through human agency in very recent times, and it may have been first introduced into the country by Neolithic man as an article of food.

In spite of these differences the conclusion may be drawn that by the Atlantic phase of the Holocene Ireland possessed a molluscan fauna not unlike that of to-day. By then the land-bridges between Ireland and Britain had probably been severed by the so-called " Neolithic Submergence ", which recreated the Irish Sea and the English Channel, and which brought migration from the east to an end. What part, if any, of the molluscan fauna survived the rigours of the glaciations, and whether or not the small group of Lusitanian species are survivors from the Pliocene, as Edward Forbes long ago postulated, is still unknown. Praeger states : " while there can be no doubt that a large proportion of the present fauna and flora reached Ireland . . . in post-Glacial times, the curiously discontinuous distribution and other features connected with many plants and animals suggest strongly that they represent fragments of the older population " (Praeger, 1950, p. 36). Unfortunately our palaeontological knowledge regarding the Lusitanian species is still almost a blank, and further work on Irish Quaternary faunas would certainly be rewarded.

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THE MOLLUSCAN FAUNA OF SOME EARLY POST-GLACIAL DEPOSITS IN NORTH LINCOLNSHIRE AND KENT

By J. P. T. BURCHELL, M.C., F.L.S., and A. G. DAVIS, F.G.S.

(*Read before the Society*, 12 *May* 1956.)

THIS report is drafted with the object of describing some very early post-glacial beds located in Lincolnshire and Kent, which contain a contemporary molluscan fauna, and of discussing the inferences which may be drawn from a detailed study of the shells in question.

The site in Lincolnshire (Sheet 54/10, 199068, scale 1 : 25,000) was discovered by one of us (J. P. T. B.) in 1952. The series of beds revealed in the upper portion of the section there are to be equated with the Sewerby Gravels of Flamborough Head, Yorkshire. These gravels can be traced southwards through Holderness and into North Lincolnshire (1, p. 8). They show a marked characteristic in that they are composed almost entirely of small platy pieces of chalk (2, p. 425). In the time scale they immediately succeed the last glacial manifestation, that which was responsible for the formation of the Hessle or Brown Boulder Clay. The Lincolnshire site lies in a valley which runs eastwards from Swallow and passes Laceby on its north side (3, p. 72). The valley has been cut through the Hessle Boulder Clay down into the underlying Chalk, and subsequently its floor became overlain by some 15 feet of coarse melt-water gravel containing large erratics. Following this melt-water stage of the Hessle glaciation there developed the formation of the Sewerby Gravel deposits, which here attain a thickness of 3 ft. 6 in. and are mainly comprised of the typical Sewerby gravel. There occurs in addition a thin layer of calcareous sand, which rests on the surface of the coarse melt-water gravel and is overlain by a grey calcareous loam (the Lower

Loam). Above the Lower Loam lies a spread of Sewerby Gravel, which in its turn is capped by a layer of grey calcareous loam (the Upper Loam). This Upper Loam is similarly followed by a deposition of Sewerby Gravel, which is often largely decalcified. The present-day surface-level of the floor of the valley at this point stands at 65 feet above O.D.

The bed of sand, together with the two overlying loams, contains a molluscan fauna yielding 18 species and characterized by the three following arctic forms :—

Columella columella (Benz)
Pisidium obtusale lapponicum Clessin
Vertigo parcedentata (Braun)

The complete list of shells recovered from the horizons is set out hereunder :—

	(1) *Basal Sand.*	(2) *Lower Loam.*	(3) *Sand in Sewerby Gravel between Loams.*	(4) *Upper Loam.*
Land Species.				
Abida secale	—	—	—	1
Arion sp.	r.	r.	r.	r.
Cochlicopa lubrica	25	49	6	32
Columella columella	50	72	7	94
Euconulus fulvus	6	22	6	20
Helicella itala	—	1	—	—
Limax sp.	6	13	1	11
Pupilla muscorum	74	110	14	117
Vallonia pulchella	171	186	84	69
Vertigo parcedentata	10	1	—	—
Vitrina pellucida	9	13	3	10
Marsh and Freshwater Species.				
Lymnaea peregra	—	—	1	—
Lymnaea truncatula	10	4	3	3
Pisidium obtusale lapponicum	1	4	—	—
Planorbis crista	1	—	—	—
Planorbis leucostoma	4	4	—	7
Succinea oblonga var. *agonostoma*	52	26	38	5
Succinea pfeifferi	23	128	32	14

Moving south to Kent, a highly significant site occurs to the north of the Aylesford–Forstal road (Sheet TQ.75, 736589. Scale 1 : 25,000). The section is exposed in a gravel pit, whose deposits here form the right-hand margin of the River Medway.

As in the case of the Lincolnshire site, coarse melt-water gravel containing large erratics occupies the floor of the valley. Overlying this gravel are some 10 feet of deposits, whose present-day surface stands at 20 feet above O.D. The beds comprising this sequence are set out hereunder in descending order :—

11–12 Tufa and/or surface soil.
10 Sub-aerial loam, stoneless and highly calcareous.
9 Fine stoneless loam, highly calcareous : upper part.
8 ,, ,, ,, ,, ,, lower part.

7 Fine stoneless loam, highly calcareous, which sometimes passes laterally into the Chalk Wash.
6 Chalk Wash, sometimes false-bedded and containing thin seams of manganese dioxide.
5 Stoneless loam, highly calcareous.
4 Chalk Wash, sometimes false-bedded and containing thin seams of manganese dioxide.
3 Dark brown clayey loam showing vertical fissuring.
2 Brown clayey and calcareous loam.
1 Coarse Chalk Wash with a brown clayey matrix.

At one spot along the section a small drainage channel may be seen, which has cut its way down through the tufa into the underlying beds (bed 12).

When a detailed examination is made of the molluscan fauna encountered in the deposits comprising the Aylesford section, it is at once evident that the period embraced extends from earliest Late Glacial to Sub-Atlantic times. Further, it would appear as though the Alleröd oscillation is reflected in deposits Nos. 3 to 7 inclusive.

A table is set out hereunder showing the number of shells (the Distribution Number) occurring in 2 lb. of the matrix of each deposit, as well as the number of species of shells present in each deposit :—

	Distribution Number.	*Number of Species.*
Deposit No. 12	125	34
11	90	29
10	180	39
9	45	22
8	55	18
7	20	26
6	30	26
5	45	28
4	20	21
3	10	27
2	—	—
1	—	—

The shells which characterize each of the twelve deposits and the climatic conditions which they reflect are summarized hereunder :—

Deposit No. 12.		
Hygromia hispida	Maximum	Sub-Atlantic
Discus rotundatus *Pomatias elegans*	Very scarce	
Deposit No. 11.		
Hygromia hispida	Maximum	Transitional
Discus rotundatus *Pomatias elegans*	Scarce	
Deposit No. 10.		
Discus rotundatus *Pomatias elegans*	Maximum	Sub-Boreal
Deposit No. 9.		
Hygromia hispida *Discus rotundatus*	Maximum	Atlantic
Pomatias elegans		

Deposit No. 8.		
Succinea oblonga var. *agonostoma*		Boreal
Vertigo percedentata		
Columella columella		
Hygromia hispida	Maximum	
Deposit No. 7.		
Succinea oblonga var. *agonostoma*		Late Glacial (Younger Dryas time)
Vertigo parcedentata		
Pisidium obtusale lapponicum		
Helicella striata		
Deposit No. 6.		
Succinea oblonga var. *agonostoma*		(Younger Dryas time)
Vertigo parcedentata		
Columella columella		
Pisidium obtusale lapponicum		
Helicella striata		
Deposit No. 5.		
Succinea oblonga var. *agonostoma*		(Alleröd oscillation)
Vertigo parcedentata		
Columella columella		
Pisidium obtusale lapponicum		
Pisidium vincentianum		
Helicella striata		
Helicella geyeri		
Deposit No. 4.		
Succinea oblonga var. *agonostoma*		Late Glacial (Older Dryas time)
Vertigo parcedentata		
Columella columella		
Helicella striata		
Deposit No. 3.		
Succinea oblonga var. *agonostoma*		Late Glacial (Older Dryas time)
Vertigo parcedentata		
Deposit No. 2.		
Nil		Last Glaciation
Deposit No. 1.		
Nil		Last Glaciation

In the following lists there are shown the names of the shells recovered from the Aylesford deposits as well as the number of each shell present in any of the deposits.

Deposit Nos.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Land Species.												
Abida secale (Draparnaud) . . .	—	—	—	9	25	1	7	—	—	3	—	—
Acanthinula aculeata (Müller) . .	—	—	—	—	—	—	1	—	1	11	1	—
Acanthinula lamellata (Jeffreys) . .	—	—	—	—	—	—	—	—	—	3	—	—
Acme fusca (Montagu)	—	—	—	—	—	—	1	—	—	2	—	—

Deposit Nos.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Arianta arbustorum (Linné)	—	—	tr.	1	2	2	tr.	—	1	tr.	tr.	3
Arion sp.	—	—	c.	sc.	r.	c.	c.	c.	c.	c.	ab.	r.
Carychium minimum Müller	—	—	—	—	3	2	—	—	1	69	6	—
Carychium tridentatum (Risso)	—	—	1	—	—	3	1	3	—	240	25	14
Clausilia bidentata (Ström)	—	—	—	—	—	—	—	—	4	17	4	3
Clausilia rolphii Turton	—	—	—	—	—	—	—	—	—	2	—	—
Cochlicopa lubrica (Müller)	—	—	1	5	11	2	3	1	1	6	—	2
Cecilioides acicula (Müller)	—	—	4	7	1	1	1	6	14	58	119	110
Columella columella (Benz)	—	—	—	2	9	1	—	2	—	—	—	—
Discus rotundatus (Müller)	—	—	—	—	—	—	—	—	28	51	8	3
Ena obscura (Müller)	—	—	—	—	—	—	—	—	—	5	—	—
Euconulus fulvus (Müller)	—	—	1	4	6	2	4	—	—	—	—	—
Helicella geyeri (Soós)	—	—	—	—	5	—	—	—	—	—	—	—
Helicella itala (Linné)	—	—	—	—	—	—	—	—	—	—	—	4
Helicella striata (Müller)	—	—	—	3	15	1	1	1	—	—	—	—
Helicigona lapicida (Linné)	—	—	—	—	—	—	—	—	—	3	—	—
Helix hortensis Müller	—	—	—	—	—	—	—	—	—	1	—	—
Helix nemoralis Linné	—	—	tr.	—	—	tr.	tr.	—	1	2	1	2
Hygromia hispida (Linné)	—	—	5	9	11	22	4	52	38	15	23	123
Hygromia striolata (C. Pfeiffer)	—	—	—	—	—	—	—	—	—	2	—	—
Limax maximus Linné	—	—	1	—	—	—	—	—	—	—	—	—
Limax sp.	—	—	7	12	3	4	1	—	1	9	1	1
Marpessa laminata (Montagu)	—	—	—	—	—	—	—	—	—	3	4	—
Oxychilus cellarius (Müller)	—	—	2	1	1	—	—	1	17	28	1	6
Pomatias elegans (Müller)	—	—	—	—	—	—	—	—	12	21	7	4
Punctum pygmaeum (Draparnaud)	—	—	2	7	21	6	9	—	—	4	1	—
Pupilla muscorum (Linné)	—	—	5	17	65	16	26	6	1	2	3	7
Retinella nitidula (Draparnaud)	—	—	—	—	—	—	—	—	1	10	2	2
Retinella pura (Alder)	—	—	—	—	—	—	—	—	—	6	2	—
Retinella radiatula (Alder)	—	—	—	6	9	1	4	2	5	13	2	—
Vallonia costata (Müller)	—	—	32	30	76	14	19	6	12	109	2	28
Vallonia excentrica Sterki	—	—	4	—	—	—	1	1	8	30	19	29
Vallonia pulchella (Müller)	—	—	43	13	45	4	12	3	6	32	12	40
Vertigo angustior Jeffreys	—	—	—	—	—	—	—	—	—	1	—	—
Vertigo antivertigo (Draparnaud)	—	—	6	2	1	—	1	—	—	1	—	1

Deposit Nos.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Vertigo parcedentata (Braun)	—	—	2	8	16	4	10	1	—	—	—	—
Vertigo pusilla Müller	—	—	—	—	—	2	—	—	—	10	2	—
Vertigo pygmaea (Draparnaud)	—	—	4	—	—	—	—	—	—	1	1	3
Vitrea crystallina (Müller)	—	—	—	—	—	—	1	4	2	26	3	1
Vitrina pellucida (Müller)	—	—	—	—	3	1	—	—	1	—	—	—
Marsh and Freshwater Species.												
Bithynia tentaculata (Linné)	—	—	—	—	—	—	—	—	—	—	—	12
Lymnaea palustris (Müller)	—	—	1	1	3	1	—	1	—	—	1	21
Lymnaea peregra (Müller)	—	—	—	—	—	—	—	—	—	—	—	32
Lymnaea truncatula (Müller)	—	—	5	6	9	4	—	—	—	4	—	—
Pisidium casertanum (Poli)	—	—	4	—	19	2	1	—	—	—	—	25
Pisidium milium Held	—	—	—	—	—	—	—	—	—	—	—	1
Pisidium cf. *moitessierianum* Paladilhe	—	—	—	—	—	—	—	—	—	—	—	1
Pisidium obtusale lapponicum Clessin	—	—	—	—	7	2	1	—	—	—	—	—
Pisidium subtruncatum Malm	—	—	—	—	—	—	—	—	—	—	—	2
Pisidium vincentianum Woodward	—	—	—	—	2	—	—	—	—	—	—	—
Pisidium sp.	—	—	—	—	—	—	—	—	—	—	—	7
Planorbis albus Müller	—	—	—	—	—	—	—	—	—	—	—	1
Planorbis crista (Linné)	—	—	—	—	—	—	—	—	—	—	6	3
Planorbis laevis Alder	—	—	2	—	—	—	—	—	—	—	1	—
Planorbis leucostoma Millet	—	—	4	—	4	—	2	—	—	—	—	106
Segmentina complanata (Linné)	—	—	—	—	—	—	—	—	—	—	—	11
Succinea oblonga var. *agonostoma* (Küster)	—	—	54	33	96	71	22	36	—	—	—	—
Succinea pfeifferi Rossmässler	—	—	—	—	—	—	—	37	2	—	4	18
Succinea sp.	—	—	4	—	—	—	—	—	—	1	—	—
Valvata piscinalis (Müller)	—	—	2	—	—	—	—	—	—	—	—	—
Zonitoides nitidus (Müller)	—	—	—	—	—	—	—	—	—	1	—	—

The two following particulars are common to both the Lincolnshire and the Kent sites :—

1. The molluscan fauna first reappears immediately in the wake of the last glaciation.
2. The presence in that re-established fauna of the shells of *Columella columella*, *Pisidium obtusale lapponicum*, *Succinea oblonga* var. *agonostoma* and *Vertigo parcedentata*.

These four species are cold loving and become extinct with the advent of Boreal times.

The Lincolnshire section is confined to the earliest part of the Late Glacial times, whereas the succession of deposits at the Kent site is a long one and illustrates most clearly the development of the molluscan assemblage and the variations caused to it by climatic fluctuation.

The high increase of the Distribution Number shown for deposit No. 5 at Aylesford, coupled with the geological and molluscan characteristics of deposits Nos. 3 to 7, suggests that these deposits are connected in age with those laid down in Scandinavia at the time of the Alleröd Oscillation.

The optimum conditions reflected by the marked increase of the Distribution Number for deposits Nos. 5 and 6 would not seem to allow a correlation to be made with the Boreal period, since the molluscan fauna of the deposits in question is characterized by cold-loving species. There is evidence that during Boreal times the winters were cold and the summers hot and dry (7, p. 364; 8, p. 62), and that at the beginning of this period there immigrated the first forest-forming trees, which demanded a comparatively warm climate. Conditions obtaining at Aylesford during the formation of deposits Nos. 3 to 7 cannot be reconciled with those required for the Boreal period (9, pp. 185–192).

The authors are indebted to Mr. S. P. Dance for kindly determining the species of *Pisidium* here recorded, and to Mr. B. W. Sparks for his identification of most of the shells recovered from the Laceby deposits.

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MOLLUSCA FROM LIMESTONE IN SKYE, WITH SPECIAL REFERENCE TO *PYRAMIDULA RUPESTRIS* (DRAPARNAUD)

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(*Read before the Society*, 17 *March* 1956.)

A characteristic feature of the ecology of the Scottish Highlands and Islands is an environmental lack of calcareous rocks. The importance to the distribution of snails of such isolated outcrops of limestone as do occur, was stressed in several papers by Roebuck (references in Hunter and Hunter, 1955), and aspects of this are discussed by Boycott (1934). A special survey was made by Boycott and Oldham (1936) of the land and freshwater Mollusca on the most northern limestone outcrops in Scotland (i.e. in vice-counties 106 and 108). These outcrops on which they collected form part of the Durness Limestone, a name given to the Cambrian (and Ordovician) strata of dolomites and pure limestones which are exposed to the west of the Moine Thrust, along a line from the south of Skye to Durness and Eriboll on the north coast of the Scottish mainland. Along this line there is no continuous outcrop through the north-west Highlands, but a series of limestone islands occur, separated by gaps of up to 25 miles. The more important areas are: (1) in the Broadford-Torrin-Ord region of the Island of Skye, (2) around Kishorn at the base of the Applecross peninsula, (3) between Ullapool and Strath Kanaird, (4) east of Elphin around Loch Urigill, (5) around Inchnadamph in the Assynt district and (6) around Durness and Eriboll on the north coast. Details of these and smaller outcrops are given in the mineral resources survey report of Robertson, Simpson and Anderson (1949). In all these areas dolomites are abundant, while non-dolomite limestones are most abundant at the ends of the series, at Durness and in Skye. The rocks of the Durness Limestone form the only calcareous areas of any extent north and west of the Great Glen Fault.

The present note results from casual collecting on two days in July 1955 on outcrops of this limestone in Strath Parish, Island of Skye. These outcrops were situated on the shore of Loch Slapin below Torrin village, near Loch Cill Chriosd in Strath Suardal, and on the northern slopes of Beinn Suardal about two miles south of Broadford. Conditions were very dry, and only eight species of land snails were seen, seven of them being more or less ubiquitous forms: *Cochlicopa lubrica* (Müller), *Lauria cylindracea* (da Costa), *Clausilia bidentata* (Ström), *Balea perversa* (*L.*), *Discus rotundatus* (Müller), *Oxychilus alliarius* (Miller) and *Vitrina pellucida* (Müller). It should be realized, however, that common as these species are over most of the British Isles, their collection on the acidic soils which cover the greater part of the Island of Skye would be highly uncertain. The species can readily be collected over the Durness Limestone. On a limestone outcrop forming a characteristic Karst boss on the northern slopes of Beinn Suardal, above the Broadford-Elgol road, *Pyramidula rupestris* (Draparnaud) was abundant among broken pieces of rock. The discovery of *P. rupestris* in Skye not only establishes a new vice-comital record (for North Ebudes, vice-county 104), but is of importance in relation to the previously recorded distribution of the species. It is generally distributed in England and Wales, especially on limestone (Boycott, 1934 ; Ellis, 1951). In Scotland there are authenticated records for only 5 out of 41 vice-counties, the localities all being lowland (in the broad sense), and the most northerly one being in Mid Perth (vice-county 88). Apart from these, there is an early unconfirmed record from over 130 miles to the north, in West Sutherland (vice-county 108), actually at Durness itself ! This occurrence is reported in Peach (1884), but later collectors in the same area (Boycott and Oldham, 1936) did not find the species again. It is of interest that Booth (1913) also collected in the Strath Parish of Skye, and on other outcrops of limestone in the Highlands, and nowhere recorded *Pyramidula*. The habitat at Beinn Suardal where the species was collected closely resembles outcrops of the same limestone visited by the present author at Inchnadamph, Eriboll and Durness. The rocks form small-scale Karst scenery, soil being largely limited to the narrow vertical fissures or " clints " between the meandrine masses of rough limestone, and the characteristic plants include mats of *Dryas octopetala* and *Geranium robertianum*.

About a mile away from the Skye locality for *P. rupestris*, and receiving drainage from limestone, is Loch Cill Chriosd. This loch is relatively eutrophic for the Highlands, and six species of Mollusca were collected. Three were the widely distributed *Ancylus fluviatilis* Müller, *Lymnaea* (*Radix*) *peregra* (Müller) and *L.* (*Galba*) *truncatula* (Müller). *Planorbis* (*Gyraulus*) *albus* Müller was also frequent and, although this is not a new record for vice-county 104, it may be the first time that the species has been recorded in the Island of Skye. [The only previous record for vice-county 104 is that of Harrison (1936, 1937) for a loch on the Island of Raasay.] Specimens of *Planorbis* (*Anisus*) *leucostoma* Millet were collected at the base of stems of *Schoenoplectus lacustris*, establishing a new record for vice-county 104. These specimens were even more stunted than the characteristic form of this species which occurs in Loch Lomond (see Hunter, 1953). No special collection of *Pisidium* was made, but two specimens found close inshore proved to be *Pisidium nitidum* Jenyns, also a new vice-comital record. Booth (1913), who collected in this locality in 1910, records no *Planorbis* spp. and notes *Lymnaea peregra*, *L. truncatula* and *Ancylus fluviatilis* from " ditches on the margin of Loch Cill Chriosd ", but he does state that the burns were in spate and the loch high on the day of his visit. Booth also reports " *Pisidium fontinale* ", " *P. pusillum* " and *P. milium* from the area. The present author hopes to examine the molluscan ecology of this loch in more detail, and to compare it with certain other fresh waters of isolated limestones in Scotland. These include the lochs of the Island of Lismore, where the molluscan fauna is rich and calciphile species *do* occur (Hunter, 1955), and the lochs of the more northerly outcrops of the Durness Limestone which support none of the species considered calciphile further south (Boycott and Oldham, 1936). As Boycott (1936) noted, the number of molluscan species in fresh waters generally decreases in the British

Isles towards the north and west; certain aspects of this in the freshwater lochs of the west of Scotland are discussed by Hunter (1956).

The present records from limestone in Skye support the conclusion of Boycott and Oldham (1936) that some species, relatively indifferent to the absence of lime in more southerly parts of Britain, become increasingly calciphile towards the north of Scotland. More recently, Hunter and Hunter (1956) have reported an example of similar change with increase in altitude within Scotland.

Voucher specimens for the three vice-comital records reported above have been submitted to, and their identification confirmed by, Mr. A. E. Ellis, Recorder of the Society, to whom my sincere thanks are once more due. It is a further pleasure to acknowledge again the continued interest of Professor C. M. Yonge, C.B.E., F.R.S., and the great help of my wife.

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PINNA FRAGILIS IN ORKNEY

By Robert Rendall

(*Read before the Society*, 20 *October* 1956.)

In my paper on "Traill's List of Orkney Mollusca" (1953) I drew attention to the rare occurrence of *Pinna fragilis* in Orkney waters. Up to that time I knew only of two records for the islands, the one mentioned in Traill (1830) and that of a specimen taken on a fishing line in Scapa Flow in March, 1951. Since then, however, two further records have come to light, and a fresh one has been made. The Scottish Home Department's Marine Laboratory, Victoria Street, Aberdeen, kindly inform me that during the year 1937 they obtained three specimens from grounds off Copinsay, to the south-east of our islands. They were received from Aberdeen trawlers, two being got on 23 February and one on 26 October. They measured from 6 to 8 inches in length, and therefore could not have been fully grown.

This year a living specimen was brought to Stromness by a seine-net motor-boat that had been fishing off Noup Head, Westray, to the north-west of Orkney, on the other side of our island group from Copinsay. The average depth here by the Admiralty Chart of 1850 is from 75 to 90 fathoms, with holes going down as far as 112 fathoms. The specimen, acquired by a well-known local naturalist, ex-Provost J. G. Marwick of Stromness, is now through his kindness in my possession. It measures 12 inches in length. This brings the total number of specimens obtained in Orkney during the last 150 years up to six.

This largest of British Mollusca, rare in the north, was collected in deep water in Shetland by Edward Forbes (Forbes & Hanley, 1849), and has also been procured from the west coast of Scotland. Jeffreys (1863) observes that " it has not been noticed as occurring anywhere north of Shetland ". These Orkney records, therefore, made near the extremity of its northern range of distribution, would seem to have a special interest.

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***Nucella lapillus* (*L.*) with double operculum.**—Whilst cleaning some specimens of *Nucella lapillus* taken on Pte. du Moulinet at Dinard, Ille et Vilaine, France, on 6 June 1956, I noticed that one had a double operculum. This consists of a smaller outer operculum superimposed on a larger one, the two being joined together at the outer margin. The shell is otherwise quite normal for this region, rather small and squat with a sharp spire.

H. E. J. Biggs.

(*Read before the Society*, 17 *November*, 1956.)

POMACEA OF THE SIERRA DE MERIDA, VENEZUELA

By T. Pain

(*Read before the Society*, 17 *March* 1956.)

The range of the Sierra Merida is the Venezuelan continuation of the Cordellera Oriental, although separated from it by lower hills (about 1,700 metres), between the headwaters of the Rio Grita and Rio Uribante (Catatumbo and Orinoco drainages).

The only species of *Pomacea* reliably recorded from this region belongs to the subgenus *Limnopomus* Dall, and the oldest name available for it is *camena* Pain (1949). As is often the case with *Limnopomus*, *P.* (*L.*) *camena* is a highly variable species, both in respect of size and shape, as well as colour. A number of names have in consequence been given to it, resulting in considerable confusion, so a detailed synonymy is set out below.

Lack of an adequate range of specimens for comparison has in the past been the main cause of the creation of synonyms, for some of which the author was inadvertently responsible.

Through the kindness and generosity of Sr. Sergio Arias of the Sociedad de Cincias Naturales la Salle in Caracas, the author has been able to examine a fine series of well localized specimens, the study of which shows beyond doubt that but one highly variable species exists in the region.

Pomacea (*Limnopomus*) *camena* Pain.

Ampullaria interrupta Alderson, 1924. *Proc. Malac. Soc.* **16,** 50, text fig. (not of Sowerby).
,, ,, Alderson, 1925. *Studies in Ampullaria*, 52, pl. 11, fig. 7.
,, *pertusa* Alderson, *ibid.*, 55, pl. 11, figs. 9, 10 (not of Sowerby, 1894).
Pomacea (*Limnopomus*) *pertusa* H. B. Baker, 1930, *Occ. Papers. Mus. Zool. Michigan*, **210,** 8 (not of Sowerby, 1894).
Pomacea camena Pain, 1949. *Proc. Malac. Soc.* **27,** 258, pl. 13, figs. 5 & 6.
,, (*Limnopomus*) *meridaensis* Pain, 1950. *J. Conch.* **23,** 109.
,, (*Limnopomus*) *meridaensis* Arias, 1952. *Memoria della Sociedad de Cincias Naturales la Salle*, **15,** 55, pl. 1, fig. 7.

Distribution: Sierra de Merida Venezuela, Lagunella Edo Merida (Pain, type locality), Kumana y Los Angeles del Takuks (Arias), "Merida" (Alderson, type of *meridaensis* Pain).

Measurements (in Millimetres).

			Aperture		
	Length.	*Width.*	*Length.*	*Width.*	
(1)	35	25	26	16	Type of *P.* (*L*) *camena* Pain (B.M. No. 1946–10, 2, 3).
(2)	50	40	34	22	Type of *meridaensis* Pain (Alderson Coll.).
(3)	54	41	38	23	Shell figured by Alderson as *pertusa* (Sow.).
(4)	62	50	47	27	"Merida" (L. A. C. W. Venmans Coll.).
(5)	54	40	36	22	Paratype of *meridaensis* (Pain Coll.).
(6)	52	40	38	24	"Merida," Venezuela (Boucard) (Pain Coll. ex Sowerby).
(7)	53	40	36	22	Lagunillas, Edo Merida (Arias, Pain Coll.).
(8)	47	38	32	19	,, ,, ,, ,, ,,

P. (*L.*) *camena* was founded upon what has since proved to be an immature holotype, which together with a number of equally immature paratypes were collected by the author in 1940. Sr. Arias has since, however, obtained at the type locality a series of adult shells, which show this species to be identical with *P.* (*L.*) *meridaensis* Pain. (Alderson Coll. Merida, Venezuela, without more definite locality.)

Alderson (1925) gave two very good figures of adult *camena* (Pl. 11, figs. 9, 10) under the impression that they represented Sowerby's *pertusa.* He did not apparently notice the resemblance between them and the shell he figured on the same plate (fig. 7) as an adult example of *P.* (*L.*) *interrupta* (Sowerby).

Ampullaria pertusa Sowerby (1894, 48) was described from a shell labelled *A. linnaei* in the Cuming collection at the British Museum. It is without locality. Sowerby's figure of the type was a very poor one and it was subsequently refigured by the author (Pain, 1949). When, however, Sowerby's type was re-examined it was found that it did not show the minute punctures characteristic of all *Limnopomus.* It is furthermore much thinner than any of the typical *Limnopomus* from the Sierra Merida, with a far larger aperture and has every appearance of belonging to *Pomacea. s.s.*

Amongst a series of *P. urceus guyanensis* (Lamarck) from British Guiana, obtained by the author in 1938, occurred a shell identical in all respects with Sowerby's type of *pertusa*, and no doubt regarding its true identity remained. *P. pertusa* (Sowerby 1894) becomes therefore a synonym of *P. urceus guyanensis* (Lamarck).

Although *P. pertusa* was made a variety of *P.* (*L.*) *castelloi* (Sowerby) from Colombia in a previous paper (Pain, 1949), I now consider *P.* (*L.*) *camena* Pain to be an entirely separate species.

H. B. Baker (1930) was quite unable to place Sowerby's *pertusa*, which in view of the very poor type figure was understandable; he was farther led astray by Alderson who gave good figures under the name *interrupta* Sowerby (1909) of both the latter species (Pl. 11, fig. 6) and *P.* (*L.*) *camena* Pain (Fig. 7), this shell afterwards becoming the type of the synonymous *P.* (*L.*) *meridaensis* Pain (1950).

P. (*L.*) *interrupta* (Sowerby) although also from Venezuela, is a much smaller species, noticeable for its beautifully spotted varices. It is not known from the Sierra Merida.

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NOTES ON *HYGROMIA CINCTELLA* (DRAPARNAUD)

By Rev. H. E. J. Biggs, F.L.S.

(*Read before the Society*, 12 *May* 1956.)

Whilst casually turning over limestone chips, leaves, etc., by the roadside in Ilsham Valley, Torquay, Devon, on 6 March 1956, I came across a few dead shells of *Hygromia cinctella* (Draparnaud). The weather had been dry for some days and there was a very cold north-east wind. More careful search later that day revealed five living specimens, mostly immature, adhering to the undersides of stones and leaves. This was close to the first pillar-box on the left-hand side of the road going towards the sea. Further search the following day lower down the valley on exactly similar terrain yielded no *H. cinctella*, but I have little doubt that more examples could be found in this sheltered valley along its length in more favourable weather. The snails found with *H. cinctella* were *Clausilia bidentata* (Ström), *Helicigona lapicida* (L.), *Helix hortensis* Müller, *H. aspersa* Müller (mostly of the form *unicolor* Moquin-Tandon), *Hygromia striolata* (Pfeiffer), *Monacha granulata* (Alder), *Discus rotundatus* (Müller) and *Oxychilus draparnaudi* (Beck).

Comfort (1951) says " It does not seem to have reached the cliff gardens at Torquay and Babbacombe ". Unfortunately I did not verify this, though it is probably still true, the species favouring the more sheltered valley.

There are two colour forms of this shell, one a pale chestnut or shades of horn colour, the other pale greenish white. The small collection I was able to make at Torquay consisted of six of the former and four of the latter. I collected three specimens at Sossano in northern Italy in 1918, two of which are pale greenish white and one pale horn colour. Mr. B. Verdcourt kindly sent me an example collected at Genoa in February 1952, which is greenish white.

The following is the original description of *H. cinctella* (Draparnaud, 1801, 87): " Coq. sub-trochiforme, carénée, brune ; carène blanche ; péristome simple." In a later work (1805, 99) he gives the following diagnosis : " H. testa subconica, subdepressa, cornea, carinata ; carina alba, peristomate simplici," and lower down describes the shell as " cornée, brunâtre ". Potiez and Michaud (1838, 78) gave the name *fusca* to the brown form, but it is clear from Draparnaud's description that this is the typical form, and it is the pale greenish white form which requires a name. I accordingly propose the varietal name *translucida* for the latter form of *H. cinctella*, and designate as type and paratype of this variety the examples which I collected in the hills near Sossano, Venetia, in 1918. It may be added that var. *fusca* Potiez and Michaud is *nomen nudum*, though it was described by Moquin-Tandon (1855, 215) : " Coquille brunâtre ou brune."

With regard to distribution, Moquin-Tandon (1855, 216) cites le Maine-et-Loire ; la Vienne ; le Rhône ; l'Isère ; la Drôme ; la Gironde ; les Landes ; les Basses-Pyrénées ; les Pyrénées-Orientales ; le Gard ;

Vaucluse ; le Var ; la Corse ; à Fango, Furianti ; Bastia. Germain (1930, 259) states : " Habite sous les broussailles, dans les haies, les bois, au bord des ruisseaux, souvent sur les Ronces et les Orties et assez fréquemment, dans la Provence maritime, sur les Orangers. La France centrale et méridionale ; plus répandu dans le Midi où il est parfois assez commun (environs de Nice, de Cannes, de Grasse ; environs d'Avignon . . .) ; rare en Corse, à Bastia ; signalé à tort dans la Vienne et le Maine-et-Loire ; très rare, fossile, dans les brèches quaternaires de Menton (Alpes-Maritimes)." In view of our present knowledge of the distribution of this species, it would seem that Moquin-Tandon may have been right and Germain too cautious.

At Dinard, Ille-et-Vilaine, on the coast of Brittany, in September 1955, I took eight living specimens of *H. cinctella*, all of the typical form, under stones near the Marine Laboratory. I also found a few dead shells at the foot of the cliff at Plage Malouines, somewhat to the west. In June 1956 I again visited these localities and found only a few very young individuals near the Marine Laboratory. At the Malouines site I found only one dead shell, the largest I have so far seen (12·8 × 8·6 mm.). The largest shell (also dead) I found at Torquay measured 11·5 × 9·2 mm. I believe this is the first record of *H. cinctella* for the département of Ille-et-Vilaine and possibly the first for the coast of Brittany.

It would appear that *H. cinctella* has been creeping across France in the past century, and it is not altogether surprising that it has found its way into south-west England. We may look forward to further discoveries of this species over a wider area.

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EUBRANCHUS TRICOLOR TRICOLOR FORBES IN ORKNEY

By ROBERT RENDALL

(*Read before the Society*, 20 *October* 1956)

ON 19 September 1956, when out with the Fishery Research Vessel *Kathleen* from the Marine Laboratory, Aberdeen, I obtained a single specimen of *Eubranchus tricolor tricolor*. I got it on a flat encrusted stone, taken in an Anderson bucket dredge from 8 fathoms in the sound between the island of Rousay and the mainland of Orkney. This would appear to be a first record for Orkney of typical *tricolor*.

Winckworth got one specimen of *E. tricolor pallidus* (Alder & Hancock), on sand in Stromness Harbour on 23 April 1917. In his " British Marine

Mollusca " (1932, 236) he equates this form with *picta*, the revised name given to it by Alder & Hancock (1847) after they had met with more and brighter coloured examples. The name *picta* was followed by Forbes & Hanley (1851) and by Jeffreys (1869), but *pallidus* was restored by Winckworth, though only as a form of *tricolor*. In Winckworth's " Additions and Corrections " (1951, 133), however, it is again made a species in its own right, distinct from *tricolor*, and is now named *Eubranchus pallidus*.

Eubranchus farrani Alder & Hancock also appears in Gardiner's Marine Census map for Orkney, but as there seemed to be some uncertainty about the record I did not include it in my " Mollusca Orcadensia " (1956). Alder & Hancock describe it as allied to, but distinct from, *tricolor*. It does not appear (at least under the name *farrani*) in Winckworth's British List.

My own *tricolor* was clearly recognizable as the *tricolor* of Alder & Hancock. It had the distinctive dark violet in the central gland of the branchiae and the brilliant golden yellow on their tips. It was a fascinating animal to watch, extremely active, and during its peregrinations in a shallow dish of saltwater it frequently erected itself, somewhat as a caterpillar does, on the posterior part of its foot, and with exploratory caution gave sharp tentative dabs on a piece of rock in front of it with one of its dorsal tentacles. I confirmed that it " rolled itself into a ball " when irritated, a habit first observed by Forbes. When viewed through a magnifying glass it was an object of extraordinary beauty as well as of scientific interest.

On the same day I obtained a specimen of *Acanthochitona crinitus* (Pennant), also on a small stone from the same dredging. At home I verified Jeffreys's observation that this species can crawl backwards as well as forwards. This I did by placing the creature head foremost toward a strong light : instead of turning it simply reversed its motion. The species was reported by Jeffreys as being found by him in Shetland. Many years ago I got a single specimen near extreme low water mark at the point of Carness, near Kirkwall.

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THE RADULA OF "*LATIAXIS*" *FRITSCHI*, AND DESCRIPTION OF A NEW FOSSARID

By K. H. Barnard

(*Read before the Society*, 20 *October* 1956.)

Many South African shells are known only from their shell characters, and it is not surprising that some of them have been assigned to wrong genera. One example is *Rapana fritschi* Martens, 1874 (= *Latiaxis rosaceus* Smith, 1903), which was included in Tomlin's "Catalogue of recent *Latiaxis*" (1935, *J. Conch.* **20**, 181). This genus is included with *Coralliophila* and *Magilus* in the *Magilidae*, a family characterized, as far as is known, by the absence of a radula.

The South African species, however, has a very long radula, of at least 340 rows, which closely resembles that of *Tritonalia* (cf. Thiele, 1929, *Handbuch*, fig. 327) of the family *Muricidae*. The shell is not at all a typical *Latiaxis*, and Martens seems to have been much nearer the mark in assigning his species to *Rapana*. I propose to include *fritschi* in *Tritonalia*.

The following specimen of a Fossarid was dredged in shallow water in Mossel Bay by a member of Prof. J. H. Day's staff at the University of Cape Town. The base was slightly damaged and the operculum missing. Univ. Cape Town Ecological Survey No. MB. 65.Z.

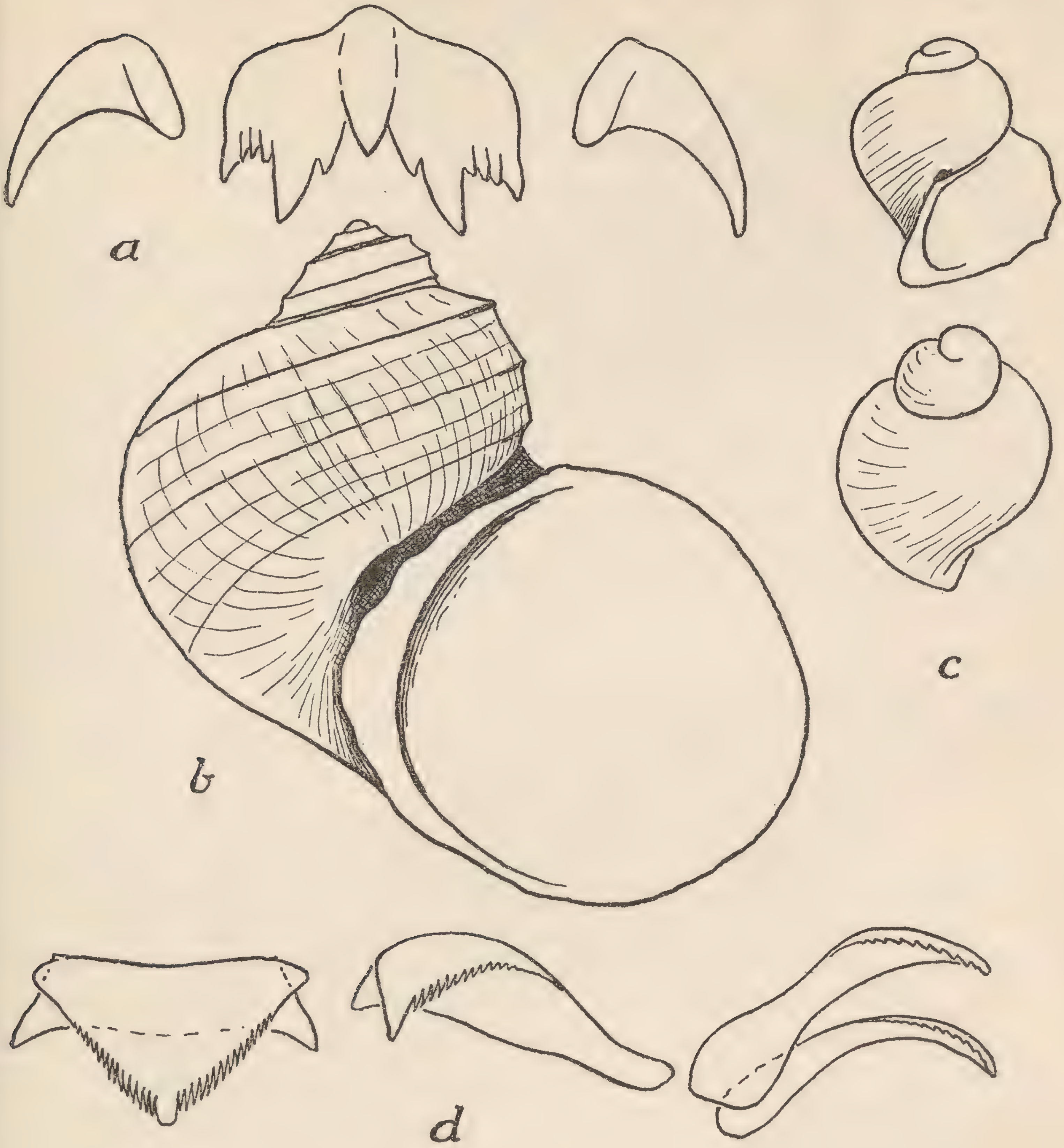
Megalomphalus mosselensis n.sp.

Shell thin, white with brown periostracum; whorls 4, protoconch and 1st whorl smooth, 2nd with 3 equidistant spiral costae, continuing on to body-whorl with obscure intermediate costulae, base smooth, growth lines not strongly marked; narrowly umbilicate; peristome free, subcircular, slightly revolute. Alt. 9 mm., diam. aperture 5·25 mm.

Viviparous. Embryo ex utero alt. 0·75 mm.

Radula with about 45 rows, but slightly damaged and probably some half dozen rows missing. The median denticle of the central plate is blunt, even in unworn teeth.

The species seems to fit into *Megalomphalus*, but perhaps might be better in *Couthouyia* on account of its narrow umbilicus.



a. Radula of *Tritonalia fritschi* (Martens).
b. *Megalomphalus mosselensis* n.sp.
c. Ditto, embryo ex utero.
d. Ditto, central, lateral and marginal plates of radula.

REVIEWS

Cowry Shells of World Seas. JOYCE ALLAN. Pp. x, 170; 15 plates (6 in colour), one text-figure. Georgian House, Melbourne, 1956. £3 3*s*.

IT is now some years since the last of the 19th century monographs on Cypraeidae went out of print, and their present scarcity and high cost makes Miss Allan's book the more welcome. In it she deals not only with Cypraeidae, but also with Amphiperatidae, Pediculariidae, Eratoidae and Triviidae. Some interesting information is given about the breeding habits of Cypraea; considering, however, the facilities in Australia for study of the living animal, it is disappointing that more is not made of this subject. Most of the book is devoted to descriptions of species and subspecies. Here Miss Allan has not attempted to judge between the taxonomic systems of Schilder and Schilder, and of Iredale, Steadman and Cotton, and has compromised by summarising the descriptions given by these authors. She does, however, suggest that some of the proposed Australian species might be relegated to synonymy. In the matter of genera she has usually followed the Australian authors ; the division of Cypraeidae into 13 subfamilies and 60 genera seems somewhat excessive for a family of less than 200 species, especially in view of the close resemblance between the species. The large number of illustrations were drawn by the author, many of them in colour, and are well executed. The accuracy of detail is, however, less than that of photographs, and for this reason the illustrations are not as useful for purposes of identification as the plain and coloured photographs in some contemporary publications. Miss Allan's book will nevertheless be of value to all collectors, both for the wide field which it covers as well as for its many intrinsic merits.

R. J. GRIFFITHS.

Mollusca Orcadensia. ROBERT RENDALL. Reprint from *Proc. Roy. Soc. Edinburgh*, Section B, **66,** 131–201. Printed Boards. Oliver and Boyd, Edinburgh and London. 1956. 12*s*. 6*d*.

As stated in the author's *Synopsis*, this paper brings together from all available sources records of marine Mollusca indigenous to Orkney, and besides incorporating the results of recent research, it includes a brief account of work done in the islands by earlier workers. The list is arranged in accordance with Winckworth's revised list of the British Marine Mollusca (*J. Conch.* **19,** 211–252 ; **23,** 131–134), for the convenience of those who are now so accustomed to its use. Mr. Rendall confesses that this study fulfills a resolve made in boyhood that he would compile a catalogue of Orkney Mollusca, and he is to be congratulated that this resolve, unlike so many of our hopes and intentions, has at last come to fruition after years of patient collecting and recording, carried out in the intervals between business duties and other interests. While the author acknowledges help from many private and professional naturalists, the constant appearance of R.R. on almost every page of the list shows the diligence with which he has himself searched and dredged for new records. Papa Westray, Evie, Thieves Holm, Deerness, Wyre and Shapinsay are not the least fascinating places to appear in this excellent list of Mollusca from the ancient islands of Orcades.

In conclusion it should perhaps be noted that the author continues to refer to *Trivia arctica* (Montagu) as the unspotted variety of *Trivia monacha* (da Costa), whereas the researches of Lebour in 1933 (*J. Mar. Biol. Ass. U.K.*, **18,** 477–484) showed the two to be different species.

G. L. WILKINS.

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CONTENTS.

PAGE

Lauria sempronii (Charpentier) in the English Holocene—M. P. Kerney 183
Pisidium conventus Clessin in Loch Rannoch—S. P. Dance . 191
Notes on *Vertigo moulinsiana* (Dupuy) in Hampshire and the Isle of Wight—A. G. Davis 192
Vertigo moulinsiana (Dupuy) in Dorset—A. G. and M. M. Davis 193
Notes on the *Pisidium* fauna of the Pevensey Levels district, with special reference to *P. pseudosphaerium* Favre—S. P. Dance . 195
Age determination in *Anodonta*—T. E. Crowley . . . 201
Edouardia herbigrada (Pilsbry) in Uganda—B. Verdcourt . 207
Vertigo substriata (Jeffreys) in Hertfordshire—L. Lloyd-Evans 208
A further note on *Lymnaea stagnalis* (L.) in Anglesey—N. F. McMillan 208
Notes on Dixon & Watson's " Descriptive Manual of British Land and Fresh-water Shells "—N. F. McMillan . . 209
Glypteuthria capensis: a generic correction—K. H. Barnard . 210
A Molluscan fauna from alluvium of the New River at Canonbury, North London—M. P. Kerney 211
Large *Planorbis vorticulus* Troschel near Pevensey, Sussex—S. P. Dance 212
Types of *Cypraea lynx* var. *williamsi* Melvill—N. F. McMillan 212
Review 212
Obituary: J. F. Bensley, A. G. Davis, W. L. Wilkins . . 213
Proceedings: 12 May, 20 Oct., 17 Nov., 15 Dec., 1956; 19 Jan., 16 Feb. (Annual Meeting), 16 March, 13 April, 18 May, 1957 218
Accounts for 1956 225

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And also of the Secretary of the Society.

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LAURIA SEMPRONII (CHARPENTIER) IN THE ENGLISH HOLOCENE

By M. P. KERNEY

(*Read before the Society*, 16 *March* 1957)

IN 1952 the writer found in a Holocene chalk rainwash at Oxted, Surrey, a single shell of a *Lauria*, which, though damaged, appeared distinct from either of the two British species of that genus: *Lauria cylindracea* (da Costa) and *L. anglica* (Wood). A similar imperfect shell was subsequently obtained by the late Mr. A. G. Davis, but despite further intensive collecting no more could be found. In an account of the Oxted rainwash (Davis, 1953, pp. 361–3) these specimens are listed as *Lauria sp.*, and are compared in form with the living Continental species *L. sempronii* (Charpentier).

Three years ago Mr. Davis kindly directed my attention to a second rainwash at Polhill, Kent, 8½ miles E.N.E. of Oxted, from which he had obtained some shells very like the broken fragments mentioned above. Large collections were made, with the result that 28 examples, whole and fragmentary, of *Lauria sempronii* were found. Mr. Hugh Watson examined these shells and stated that in his opinion the determination was correct, constituting the first confirmed record of this species in Britain.

Subsequent search in the Kennard collection preserved in the British Museum (Natural History) revealed a single fossil *L. sempronii* from the shaft-infillings of the Neolithic and Bronze Age flint-mines at Blackpatch, Sussex.

GEOLOGICAL EVIDENCE

1. **Oxted, Surrey** (Grid Reference TQ/383544).

Unfortunately neither this deposit nor that at Polhill can be dated with accuracy. The Oxted rainwash was described by Davis (1953) and a faunal list given. The rich assemblage is that of a damp beech woodland and scrub area and includes several locally extinct species, notably *Ena montana* and *Helicodonta obvoluta*. The absence of *Helix aspersa* and *Monacha cantiana* from the base of the deposit points to a pre-Roman date, but as these species do not favour woodland habitats this is not conclusive. However, analogy with sites of known date yielding similar faunas suggests that the Oxted rainwash is Neolithic and a little additional evidence supports this: pieces of charcoal and flint flakes of " Neolithic " type are common, the latter quite sharp and unabraded, whitened to a similar degree, and clearly a contemporary associated series.

From the molluscan faunas obtained from several fairly-well dated Neolithic sites in southern England it would appear probable that the damp Atlantic phase of the Holocene persisted, locally at least, rather later than the often-quoted terminal date of 2500 B.C.

2. Polhill, Shoreham, Kent (TQ/504601).

The second rainwash lies on the side of Polhill at 450 feet O.D., upon the precipitous western flank of the Darent Gap. It is exposed in a lane about 250 yards south of the Polhill Arms, and consists of up to 2 feet of unbedded and ungraded chalk rubble and sludge resting on shattered chalk. Evidence as to age is not satisfactory. Judging from the steepness of the slope, it seems possible that the deposit has moved downhill at several periods and that its fauna represents a mixture of many dates. Rare examples, as fragments or juveniles, of *Helix aspersa* and *Monacha cantiana* occur, but since the rainwash is riddled and disturbed by tree roots these may be introductions from the present surface. Excluding the above, 33 species were found, and if contemporary, form an assemblage characteristic of a calcareous downland area with plenty of shade and cover The abundance of *Acicula fusca* is noteworthy. On the other hand, conditions were less damp than at Oxted ; *Cochlicopa lubricella* occurs to the exclusion of *C. lubrica*, and *Pupilla muscorum*, which tends to be a xerophile, is very common.

The examples of *Lauria sempronii* (figs. 1–3, 6, 7) are in good preservation, though mostly juveniles. Two specimens of *L. cylindracea* were also found.

3. Blackpatch Flint-mines, near Patching, Sussex (TQ/094089).

Shells from this site were examined by A. S. Kennard, but no full report appeared in the official accounts of the excavations. In the Kennard collection is a glass tube containing two examples of *Lauria cylindracea* and one of *L. sempronii* (fig. 4), and labelled " Neolithic Flint Mines, Blackpatch, Patching, Sussex ". " *L. cylindracea* " is listed in Kennard's Sussex notebook from two horizons at Blackpatch ; one, the floor of a mine-gallery, is probably Neolithic and certainly pre-Middle Bronze Age in date, when the flint-mining ceased, and the second is " Early Bronze Age ", and it was at first thought that the specimens comprised shells from both levels. However, the list from the second horizon includes certain species not given in that from the first, and since just these species cannot be found in the collection, it would seem that the Bronze Age fauna was not retained by Kennard and therefore that all the shells, including the *L. sempronii*, came from the mine-gallery.

Thirty-one species are listed from the infilling of this gallery, including *Acicula fusca*, *Helicodonta obvoluta* and a very large race of *Arianta arbustorum*, all locally extinct forms attesting to a climate damper than that of the South Downs to-day (Atlantic phase). The Early Bronze Age fauna is impoverished in comparison, and a post-Roman horizon, with *Helix aspersa*, is still poorer.

FAUNAL LISTS	Polhill	Black-patch
Pomatias elegans (Müller)	281	C
Acicula fusca (Montagu)	119	R
Carychium tridentatum (Risso)	565	C
Cochlicopa lubrica (Müller)		8
C. lubricella (Porro)	38	4
Vertigo pygmaea (Draparnaud)	29	
Pupilla muscorum (Linné)	197	
Lauria cylindracea (da Costa)	2	2
L. sempronii (Charpentier)	28	1
Acanthinula aculeata (Müller)	32	C
Vallonia costata (Müller)	72	
V. excentrica Sterki	64	
Ena obscura (Müller)	48	R
Marpessa laminata (Montagu)	29	C
Clausilia bidentata (Ström)	21	C
C. rolphi Turton	2	
Cecilioides acicula (Müller)	187	R
Helicodonta obvoluta (Müller)		C
Helicigona lapicida (Linné)	6	R
Arianta arbustorum (Linné)		C
Helix hortensis Müller		C
H. nemoralis Linné	3	C
H. aspersa Müller	8	
Hygromia striolata (C. Pfeiffer)	1	R
H. hispida (Linné)	20	C
Monacha cantiana (Montagu)	9	
Helicella gigaxi (L. Pfeiffer)	1	
H. itala (Linné)	18	
Punctum pygmaeum (Draparnaud)	32	R
Discus rotundatus (Müller)	288	C
Arion sp.	Ab.	R
Euconulus fulvus (Müller)		R
Vitrea crystallina (Müller)	85	7
V. contracta (Westerlund)	67	45
Oxychilus cellarius (Müller)	47	C
O. helveticus (Blum)	3	
R. pura (Alder)	123	C
R. nitidula (Draparnaud)	89	C
Vitrina pellucida (Müller)	2	R
Limax cp. *maximus* Linné		R
"*Limax*" sp.	58	R

N.B.—In Kennard's list for Blackpatch, C = "common" (i.e. more than about 10 examples), R = "rare" (i.e. fewer than about 10).

Kennard's MS. list is reproduced on his authority, with the exception that the aggregates *Cochlicopa lubrica* and *Vitrea crystallina* were re-examined and separated into their component species. Some determinations of *Limacidae* are omitted. The list was probably compiled from shells carefully collected *in situ* and by examining the matrix within the larger helices, and not by washing samples, so that the list suggests a dearth of small forms such as *Pupilla* and *Vallonia*, which is misleading. Since for the same reason the proportions of the various species are probably biased in favour of those with large shells, the writer made no attempt to count the exact numbers of each present in the Kennard collection.

The faunas of Polhill and Blackpatch are given above in parallel columns. That from Oxted has already been published by Davis (1953, p. 362). One species must now be omitted from his list: *Abida secale* (Drap.), the three apical fragments found being derivatives from a considerably older underlying deposit in which *A. secale* is common and is associated with *Helicella geyeri* (Soós).

CHARACTERS DISTINGUISHING *LAURIA SEMPRONII* FROM *L. CYLINDRACEA*

The following notes, based on British material, are not intended to be exhaustive, but are given in the hope that they may help others to detect *Lauria sempronii* elsewhere in Britain, either living or as a fossil. *L. anglica* will not here be considered, for its distinctive apertural features set it apart at a glance.

Lauria sempronii is a smaller species than *L. cylindracea*, its shell being both shorter and narrower. The Polhill examples vary from 2·6 × 1·4 mm. to 3·2 × 1·5 mm. Pilsbry (1922, p. 56) gives 2·4 × 1·5 mm. and 3·1 × 1·4 mm. for shells from Lombardy. At Polhill the only complete associated specimen of *L. cylindracea* measures 3·8 × 1·8 mm.

L. sempronii has a somewhat cylindrical shell with a blunt flattened apex, in contrast to the rather oval tapering shape and more conical apex of *L. cylindracea*, although in both species the first whorl is of similar diameter.

In *L. sempronii* the whorls are fewer in number, a little taller in proportion to their width and more convex, so that the suture is correspondingly deeper. Young examples of two to four whorls are almost globular (fig. 7), contrasting with the trochoid form and angular periphery of young *L. cylindracea* (fig. 10).

The shell-wall is slightly thinner and more subject to breakage. Its surface, which bears numerous rather irregular fine vertical striae, similar to those present in *L. cylindracea*, is perhaps a little more polished than is usual in that species. When examining washed residues of the Polhill deposit examples of *L. sempronii* quickly caught the eye by reason of their brilliance.

The aperture is more rounded and widely open than in *L. cylindracea*. The outer and columellar margins of the peristome are generally more or less parallel to one another and are sometimes perfectly so, whereas in *L. cylindracea* the two margins are very rarely parallel and usually converge downwards, narrowing the aperture basally. The inner lip projects further forward from the axis of the shell in *L. cylindracea* than in *L. sempronii* (figs. 6 and 9).

The peristome is thickened and moderately reflected (fig. 2), but is comparatively delicate, and does not exhibit the broad flat white flange so characteristic of *L. cylindracea*. In mature English shells no denticle is present (= var. *dilucida* Rossmässler), but a single weakly developed parietal denticle is common in Continental examples (fig. 5). The long curved projecting denticle of typical *L. cylindracea* (fig. 8) is never found. The edentulous form of *L. sempronii* has been regarded as a distinct species, *Pupa dilucida* Rossmässler (1837, p. 15 and fig. 326). Pilsbry (1922) gives it the rank of a subspecies, calling it *Lauria sempronii dilucida* (Rossm.), but a little further on he remarks that it is said to occur associated with typical *L. sempronii* and declares " I cannot decide upon its status ". Some juveniles from Polhill have a thread-like parietal lamella and a weak columellar fold, the latter in one case persisting in the adult. In young *L. cylindracea*, on the other hand, the columella bears a pronounced spiral lamella, which is frequently developed more strongly than in the specimen figured (fig. 10), and which contrasts with the feeble fold borne by young *L. sempronii* in the same position (fig. 7).

In *L. sempronii* the base of the final whorl never bears the constricted spiral ridge or keel seen in *L. cylindracea* running back for about half a whorl from the lower angle of the aperture, but has a smoothly rounded form (figs. 6 and 9). Lastly, the umbilicus is slightly larger in *L. cylindracea* than in *L. sempronii*.

The outline drawings show most of these characters. Good coloured illustrations of recent *L. sempronii* will be found in Pilsbry (1922, pl. 7, figs. 2, 3). The original figures of Charpentier (1837, pl. 2, fig. 4) are well drawn and leave no doubt regarding the identity of his species.

Recent Distribution and Ecology

Lauria sempronii is a widely distributed and fairly common species in southern Europe, where to some extent it replaces *L. cylindracea*. It is recorded from the Pyrenees, from many localities in southern and south-eastern France (Haute-Garonne, Juras, French Alps, Maritime Alps, etc.), the south side of the Alps in Switzerland, North Italy, the Tyrol, Corsica, Sardinia, the Balkan Peninsula and the Caucasus (Germain, 1930 ; Pilsbry, 1922). To-day the northern limit of the species is in the Juras.

L. sempronii is thus mainly characteristic of mountainous areas, occurring in the Swiss Alps up to a possible maximum of 3,000 feet (Mermod, 1930), but is by no means restricted to high ground. It is found in similar habitats to *L. cylindracea*, among rocks, on old walls and in mossy places, and may occur in company with that species though remaining distinct from it—an observation for which I am indebted to Mr. Hugh Watson. According to Mermod, it tends to live in rather damper situations than *L. cylindracea*. It has been claimed to have a preference for acid habitats (" silicicole ") and Charpentier's type locality was on granitic rocks around Gondo, on the south side of the Simplon (1837, p. 15). The British sites, on the other hand, are all highly calcareous.

Locard (1881, p. 80) gives the only fossil record known to the writer : " dans les alluvions du Rhône, à Bellegarde " (Department of Ain).

PREVIOUS BRITISH RECORDS FOR *LAURIA SEMPRONII*

Lauria sempronii has been erroneously recorded from Britain on several occasions, usually as a variety of *L. cylindracea.*

Rossmässler (1837, p. 15), under his new species *Pupa dilucida* (= *sempronii*), refers in his synonymy with a " ? " to the figure of *Pupa edentula* Draparnaud given in Turton's *Manual* (1831, pl. 7, fig. 80), a drawing presumably made from a British specimen. This appears to be a normal *Columella edentula.*

In 1862 Jeffreys, under his *Pupa umbilicata* Drap. (= *Lauria cylindracea*), states : " a dwarfed, toothless and thin variety is the *P. sempronii* of Charpentier " (*British Conchology*, **1**, p. 248). He does not, however, make it clear whether he regarded this form as occurring in Britain, and gives no localities. References to a " var. *sempronii* " appear in the manuals of Adams (1896, p. 96) and Swanton (1906, p. 60), and are probably copied from Jeffreys.

In 1904 L. E. Adams and R. Standen are responsible for the addition of varietal names to a list of British non-marine Mollusca (Woodward, 1904). The names are stated to be those " now generally recognized by British conchologists ". Under *cylindracea* on p. 6 occurs " v. *sempronii* Charpentier ", which would appear to indicate that the form was considered to live in Britain. The name is not given in a subsequent list by Kennard and Woodward (1914), although these authors in their *Synonymy* (1926, p. 109) regard *Lauria sempronii* as conspecific with *L. cylindracea.*

Waterston and Taylor (1906), in an account of the Mollusca of St. Kilda, state under " *Pupa cylindracea* " that the examples were " all the edentulous form and probably the same as the *Pupa sempronii* of Switzerland ". They are referring to the geographical race of *L. cylindracea* widespread in the western parts of Scotland and Ireland, and to which the name var. *anconostoma* Lowe is generally applied. This form is typically small and cone-shaped, being shorter in proportion to its breadth (although sometimes of normal length), lacks the denticle and has the thick peristome much reduced. In other features, such as the shallow suture, it resembles normal *L. cylindracea*, and is linked to the typical form by numerous intermediates. Photographs of shells from Clare Island, Mayo, showing this gradation, are given by Stelfox (1912, pl. 2, figs. 47–9). Similar forms of *L. cylindracea* are found sporadically elsewhere in Britain, and varieties in which the parietal denticle is reduced are also known on the Continent (Germain, 1930).

Pupa anconostoma was described from Madeira in 1831 by R. T. Lowe as a separate species, but subsequent writers, including Jeffreys (**5**, 1869, p. 160), Stelfox (1911, p. 97), Pilsbry (1922, p. 51) and Kennard and

Woodward (1926, p. 109) are unanimous in regarding it merely as a form of *L. cylindracea.* Lowe's figures are rather poor (1831, pl. 6, fig. 30), but an examination of his types in the British Museum leaves no doubt that this view is correct, and furthermore that *anconostoma* Lowe differs specifically from *sempronii* Charpentier. If the " var. *sempronii* " of Jeffreys, Adams and Standen, Swanton and others refers to British occurrences, it seems likely that small forms of *L. cylindracea* with a reduced peristome and denticle, including the western race (*L. cylindracea anconostoma* (Lowe) of Pilsbry), are meant. Earlier British records of *L. sempronii* are therefore probably incorrect.

CONCLUSIONS

The occurrence of *Lauria sempronii* in Holocene deposits in England is a puzzling anomaly if its present-day distribution is considered. The British localities are separated from those nearest on the Continent by some 400 miles, over which *L. sempronii* is not known to occur, nor is it found elsewhere in northern Europe. Furthermore, it is unrecorded from any pre- or interglacial deposit in this country.

Human introduction cannot be entirely ruled out, but seems rather unlikely. Alternatively, one can only suppose that after the last glaciation the as yet unsubmerged land-connection between Britain and the Continent, coupled with the more genial climate of the " Post-Glacial Optimum ", allowed *L. sempronii* to migrate northwards into southern England, where, for a time, it lived.

ACKNOWLEDGMENTS

My grateful thanks are due to Mr. A. W. Stelfox, and to the late Mr. A. G. Davis, who gave me his kind and ready help in this as in many other matters. To Mr. Hugh Watson I am especially indebted for much valuable criticism. Permission to publish figures of shells in the Kennard collection was granted by the Trustees of the British Museum (Natural History).

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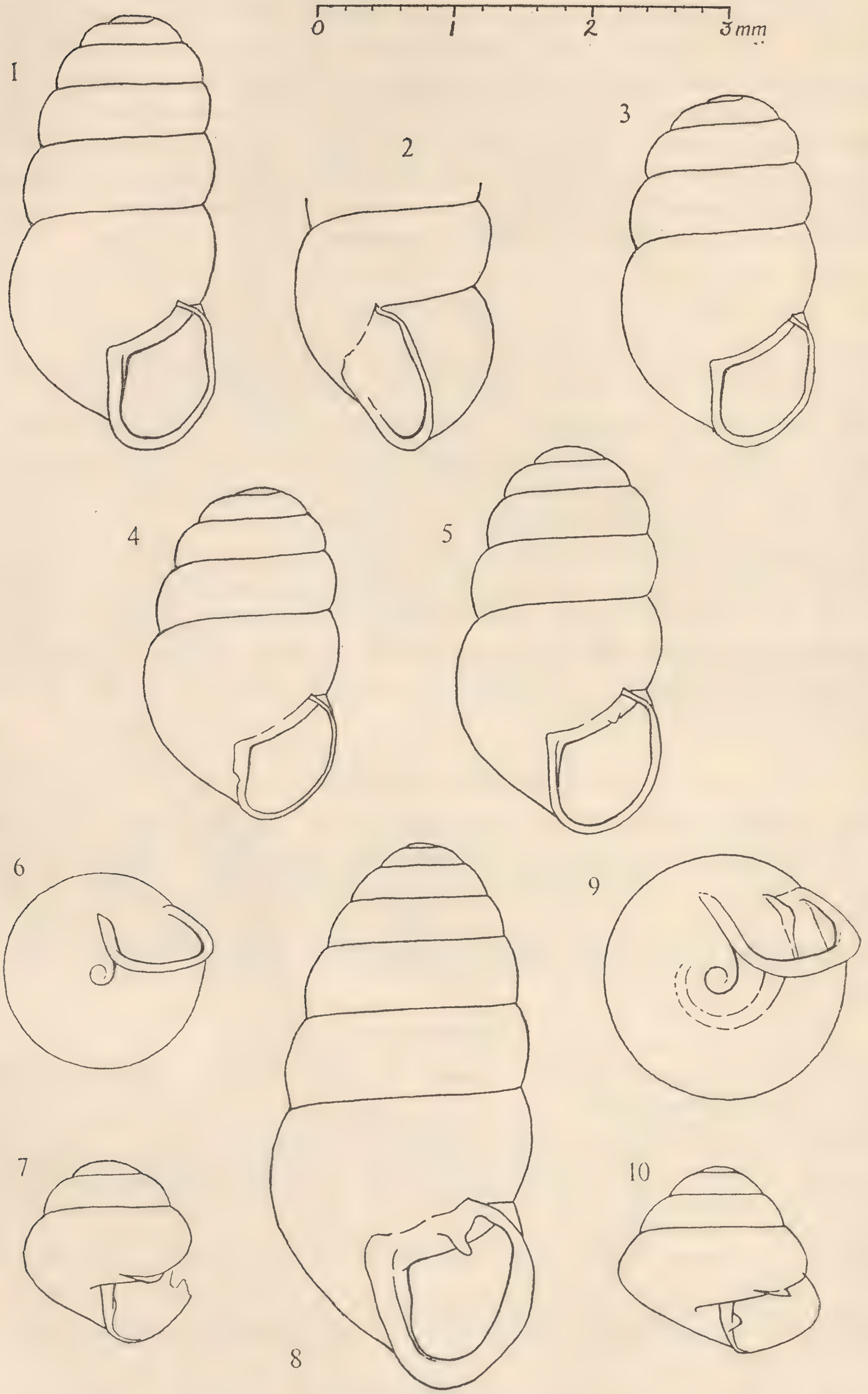

Lauria sempronii (figs. 1–7) and *L. cylindracea* (figs. 8–10).

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EXPLANATION OF FIGURES.

FIG. 1.—*Lauria sempronii* (Charpentier): a tall specimen. Holocene, Polhill, Kent.
FIG. 2.—*L. sempronii*: oblique view of aperture of same specimen as Fig. 1.
FIG. 3.—*L. sempronii*: a short specimen. Holocene, Polhill, Kent.
FIG. 4.—*L. sempronii*: a slightly immature shell with the peristome weakly developed. Holocene (Neolithic), Blackpatch flint-mines, Sussex (Kennard Collection).
FIG. 5.—*L. sempronii*: Recent. Argelès, Pyrenees (Kennard Collection).
FIG. 6.—*L. sempronii*: basal view of same specimen as Fig. 1.
FIG. 7.—*L. sempronii*: juvenile. Holocene, Polhill, Kent.
FIG. 8.—*Lauria cylindracea* (da Costa): Holocene, Wateringbury, Kent.
FIG. 9.—*L. cylindracea*: basal view of same specimen as Fig. 8, showing keel.
FIG. 10.—*L. cylindracea*: juvenile. Holocene, Wateringbury, Kent.

All figures × 15.

***Pisidium conventus* Clessin in Loch Rannoch.**—Records of this *Pisidium* are very few for Scotland, only four records being known to me, and these are all in the Perth–Inverness district. In a recent consignment of *Pisidium* from Scottish lochs, a single immature specimen of *P. conventus* was found in a small gathering from Loch Rannoch, Mid Perth. This is not a new vice-comital record, as it has been recorded from Loch Choin in the same vice-county. The same gathering contained specimens of *P. subtruncatum* Malm and *P. pulchellum* Jenyns, a very unusual association which is perhaps explained by all the specimens having been taken in mud at a depth of 20 feet, about 40 yards from a burn mouth, and it is possible that the stream-dwelling *P. subtruncatum* and *P. pulchellum* were derived from the burn and subsequently came to rest alongside the lake-dwelling *P. conventus*.

S. P. DANCE.

NOTES ON *VERTIGO MOULINSIANA* (DUPUY) IN HAMPSHIRE AND THE ISLE OF WIGHT

By A. G. Davis

(*Read before the Society*, 17 *November* 1956)

Vertigo moulinsiana was added to the English list in 1877, when it was discovered by Henry Groves in the swampy margins of the River Itchen between Bishopstoke and Otterbourne (Groves, 1880).

Dr. F. F. Laidlaw reported it at Eastleigh as late as 1918 (Conchological Society Records). A search by the writer between Eastleigh and Otterbourne in October 1956 resulted in failure. Much industralization has taken and is taking place, particularly gravel dredging along the river banks, and these changes may have destroyed the colonies. It is intended to make further searches here and in other parts of the Itchen drainage at an early opportunity.

Soil samples were examined for dead shells without result. A sample taken from the roots of *Phragmites* at Otterbourne looked very promising, but when prepared for examination yielded over 20 dead examples of *Lauria cylindracea*. The sample was taken two yards from the river bank where it is under water during floods. Elsewhere the writer has recorded living *L. cylindracea* associated with *Vertigo moulinsiana* in Dorset.

Early this year the River Test was dredged to deepen the channel at Timsbury, 1½ miles north of Romsey. Here the Test is crossed by a bridge and within a few yards of it the deposits of an older channel of the Test were disturbed by the excavator. These consisted of brown shelly loams probably of late Bronze to early Iron age. Over 40 species were present and represented a typical stream fauna, mixed with a land fauna such as may be expected in riverside herbage. A single example of *V. moulinsiana* was present and is apparently the first to be recorded from the Quarternary of the mainland of Hampshire. It is interesting to note that two examples of *Lauria cylindracea* were also found.

During the last three years the writer has examined large quantities of fossil material belonging to the Test, Avon, Stour and Itchen drainage systems, ranging in age from Mesolithic to Medieval. In all this material, consisting of many thousands of shells, Timsbury alone has provided this solitary record.

V. moulinsiana has been found living in the Isle of Wight, but not in quantity, in the marshes between Bembridge and Brading, and in boggy places on the broken ground forming the cliff at Totland Bay. At the latter place a Mesolithic tufa occurs only a few feet above the site where *moulinsiana* still holds a precarious existence. In this tufa the writer has found it in a fossil state, and it would appear that it has persisted in this part of the island for a considerable time.

Incidentally, *Lauria cylindracea* is associated in the tufa with many damp-loving forms.

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VERTIGO MOULINSIANA (DUPUY) IN DORSET

By A. G. and M. M. DAVIS

(*Read before the Society*, 17 *November* 1956)

IN October 1956 the writers and Mr. and Mrs. N. F. Davis of Ringwood carried out a search for *Vertigo moulinsiana* in Dorsetshire. First the sites recorded in 1891 by C. O. Pickard Cambridge and R. Standen were found although with some difficulty. They remain unaltered, except that they are protected by wire fencing, but no sign of the shell was seen. As it may still occur in some inaccessible parts of these bogs, these original sites are recorded below with reference to the 6 in. Ordnance Survey Sheets.

After this failure it was decided to search reed beds elsewhere and to try other drainage systems in the county. The following notes record the results of this search and it is gratifying to affirm that three stations were discovered where this local species is firmly established and another where it is present in extraordinary abundance.

PARTICULARS OF OLD AND NEW SITES

WEST MORDEN BOG AND MILL BOG, Dorset XLII.NE.—One mile west of Bloxworth Church. The road cuts Mill Bog in two. This is the Bloxworth locality of Pickard Cambridge. Success seemed possible when a small shell was observed on the reeds, but it proved to be *Columella edentula*. *Succinea putris* and *Monacha granulata* were also present.

EAST MORDEN AND LOWER MORDEN WITHY BEDS, Dorset XLII.NE.—This is the Morden or East Morden of authors. The species was formerly abundant here, where E. St. J. Burton collected it in 1902.

CHAMBERLAYNES BRIDGE, Dorset XLII.SW.—Very rare here according to Cambridge. The reeds have been thinned out in this part of the River Piddle or Trent. See also under Tanpits Coppice.

EAST BURTON, Dorset XLIX.NW.—Reed beds on banks of River Frome, 1¼ miles west of Wool Station. The site is reached by a track ½ mile north-west of Seven Stars Hotel, and is about 8 miles in a direct line from Mill Bog, Bloxworth. Here the shell was detected quite readily on the backs of the leaves and half-way up the reeds. The colony is well established and probably extends for a considerable distance on the north bank. On the recumbent reeds forming the ground layer *Vertigo antivertigo* was in even greater abundance. Other associated Mollusca are *Monacha granulata* common, *Succinea putris* frequent, *Euconulus fulvus*, *Helix nemoralis*, *Zonitoides nitidus* and *Discus rotundatus*.

BROOM HILL BRIDGE, Dorset XLVII.NE.—The southernmost of three bridges where road B3390 crosses the River Frome, about one mile south-east of Moreton Church. *V. moulinsiana* occurs on both sides of the bridge but is rare. *Columella edentula* is common and two examples of *Lauria cylindracea*, usually regarded as xerophilous or rupestral, were found on the reeds.

WADDOCK FARM BRIDGE, Dorset XLVII.NE.—This is the next bridge, a few hundred yards to the north in the direction of Moreton. Reed beds on the east side of the bridge contain a numerous and well-established colony. On the opposite side the shell was very rare. Close to the bridge it was possible to collect the shells freely within one yard of fast-moving traffic. Associated Mollusca: *Carychium minimum*, *Punctum pygmaeum*, *Succinea putris*, *Monacha granulata* and *Helix hortensis*.

THROOP, Dorset XLII.NW.—Reed beds at Bench Mark 107, 200 yards south-west of church at Turners Puddle, and 2 miles east of Affpuddle. River Piddle or Trent. A prolific colony occupies a reed bed covering some acres, where frequently 20 examples can be seen on a single reed blade. By taking a crouching posture and looking upward into the reeds over 70 shells could be counted without changing one's position. Associated Mollusca: *Helix hortensis* (banded), *Monacha granulata*, *Succinea putris*.

TANPITS COPPICE, Dorset XLII.SW.—An extensive reed bed, mixed with sallows and willows, south of Tanpits Coppice and adjacent to the Forestry Commission's Tanpits plantation, Philliols Heath. 1¼ miles north-west of Hyde House and 5 miles north-west of Wareham. The stream draining the marsh is a northern tributary of the Piddle or Trent. This site was discovered in the failing light of a late October afternoon, and after accounting for more than a dozen shells over a wide area the search had to be abandoned. There can be no doubt that a large colony is present. This colony is situated less than a mile east of Chamberlaynes Bridge, where it was reported by Cambridge.

At all the sites *V. moulinsiana* was preparing to hibernate, and almost without exception it was observed in the driest parts, particularly the margins, of reed beds. At this time of the year the reeds at the margins are turning yellow and drying off, curling lengthwise to form a hollow groove or gutter. On uncoiling these leaves five or six shells will often be found snugly fastened by a thin film of mucus into the groove formed by the curling of the leaf; it would seem that they were preparing for the winter.

At the sites where *V. moulinsiana* was abundant a search was made for dead shells. Soil samples were examined and although all the species here recorded as associated with this species were found in plenty there was no indication of the shell sought for. Does it become a prey to other animals, birds for instance, during the winter? A prolific species like this could withstand a heavy mortality.

The writers wish to thank Dr. H. E. Quick for kindly identifying the *Succinea* and Mr. C. P. Castell for helpful discussions.

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NOTES ON THE *PISIDIUM* FAUNA OF THE PEVENSEY LEVELS DISTRICT, WITH SPECIAL REFERENCE TO *P. PSEUDOSPHAERIUM* FAVRE

By S. P. Dance

(*Read before the Society*, 19 *January* 1957)

During late 1954 and early 1955 I was able to make a collection of *Pisidium* in the marshes around Pevensey, East Sussex, with a view to studying the distribution of *P. pseudosphaerium* Favre, a species little known in these islands, and but recently reported from Pevensey (Kuiper, 1949). This paper is primarily intended to augment Kuiper's account of this species, but it is hoped that the notes on the other members of the genus encountered in the district will also prove interesting.

The Pevensey Levels are bounded on the south by the coast from Eastbourne to Bexhill, and extend to Herstmonceux and Ninfield on the north. The area is broken up by very many marsh drains and streams and, apart from some high ground at Wartling, Hooe and Barnhorn, is liable to flooding ; it is very exposed, there being only a few scattered trees and bushes to be seen.

Very few Mollusca and no specimens of *Pisidium* were found in Pevensey Haven and Wallers Haven, the two main drainage systems, though recent dredging operations may account for this, and I did not inspect the excavated material. Marsh drains and ditches make up the bulk of the localities, productive of few species as a rule, but often containing many specimens, while a small stream south of Hooe produced no less than seven species in actual association. Two or three other small streams and a pond near Herstmonceux also furnished specimens.

Eleven species of *Pisidium* were found in the area. These were :—

P. amnicum (Müller)
P. casertanum (Poli)
P. personatum Malm
P. obtusale Pfeiffer
P. milium Held
P. pseudosphaerium Favre
P. subtruncatum Malm
P. henslowanum (Sheppard)
P. hibernicum Westerlund
P. nitidum Jenyns
P. pulchellum Jenyns

Notes on the Species

P. amnicum.—Found sparingly in a stream at Ninfield and quite commonly in the stream south of Hooe. Specimens from the latter stream are quite large but not heavy.

P. casertanum.—Not common. Very rare in streams. Usually associated with *P. personatum* on relatively high ground in shallow flowing ditches where the shells are often very compressed and have a rounded outline.

P. personatum.—Very common in ditches and in places liable to dry up in summer. Rarely any associated *Pisidium.* Pseudocallus well developed as a rule.

P. obtusale.—Abundant all over the marshes. Rarely associated with *P. personatum.*

P. milium.—Widely distributed and certainly the most ubiquitous species, being found in all types of habitat except those frequented by *P. personatum.*

P. pseudosphaerium.—The material upon which Kuiper based his paper (Kuiper, 1949) came from a marsh drain just north of Pevensey village, taken by A. E. Ellis, and he also mentions specimens taken by Stelfox in 1911, in the moat of Pevensey Castle. I have visited both these stations and have not been able to detect any specimens of *P. pseudosphaerium* in either. Both places must have changed considerably since the material was collected, and the occurrence of *P. pulchellum* and *P. hibernicum* in the first mentioned locality indicates quite a different set of conditions from those under which *P. pseudosphaerium* would thrive. I made one excursion to the moat around Pevensey Castle, scooping mostly around the edge as the moat was very full. The only Mollusca present so far as I could tell were *Lymnaea peregra* (L.), *L. palustris* (Müller) and *Physa fontinalis* (L.). Since 1911 the moat has been emptied, refilled and cleaned many times, which would, no doubt, greatly influence the continued survival of such a conservative mollusk as *P. pseudosphaerium.* I decided, therefore, to see if it was to be found elsewhere in the marshy areas around Pevensey. It was impossible to visit all the places likely to yield *Pisidium*, and more attention was paid to the area east of Pevensey than anywhere else. Even so, I think it can be shown that this rare *Pisidium* is quite widespread over the marshes and is one of the characteristic elements of the marsh drain fauna. All the localities where I have taken *P. pseudosphaerium* are shown on the map, and although the indications of its eastern and southern limits may be tolerably accurate it may well exist in other places further west and north-west.

Out of twelve sets containing *P. pseudosphaerium* it was the only *Pisidium* present in seven, and in three instances it was associated with *P. milium* only. One set included *P. milium* and *P. obtusale*, and another *P. milium*, *P. obtusale* and *P. nitidum.*

The *P. milium*, when present, were, in most cases, inferior in numbers and dimensions, only once were they numerically dominant and only once attained the same dimensions as the associated *P. pseudosphaerium.* This would seem to confirm Kuiper's statement: "In habitats in which *P. pseudosphaerium* is the numerically dominant *Pisidium* it often attains markedly larger dimensions than the associated *P. milium.*" *P. obtusale* was represented by one individual only in each case, and where *P. nitidum* occurred only two specimens were present. Both *P. obtusale* and *P. nitidum* were smaller than the associated *P. pseudosphaerium.*

Kuiper gives the dimensions of the largest *P. pseudosphaerium* from Pevensey as 3·25 × 2·6 × 1·7 mm. Several in my collection are larger than this, one of them measuring 3·5 × 2·8 × 2·0 mm., though his statement "generally under 3 mm. long" is quite true for the majority of the Pevensey specimens.

The "incrustation of micro-organisms which frequently covers the whole shell of *P. pseudosphaerium*" is another characteristic of this species, and in my material I found that while it was broadly true to say that the

P. pseudosphaerium had some trace of incrustation on them, in some cases there was none at all and often the associated species were a little incrusted too. This is true also of the specimens found at Lewes (Dance, 1956).

All the *P. pseudosphaerium* were taken in marsh drains, except on two occasions when a few were found in the mud at the side of Waterlot Stream associated with *P. milium*, and in the same stream I found a solitary example under a leaf of *Potamogeton natans*. The flow of water through this stream was practically negligible, however, and several snails were taken here covered with colonies of the alga *Batrachospermum*, which often attaches itself to freshwater snails where there is little movement of the water.

I did not make extensive collections of the associated Mollusca but made notes in the field, only taking the rarer or more critical species home for further examination. Common associates were: *Sphaerium corneum* (L.), *Planorbarius corneus* (L.), *Segmentina nitida* (Müller), *Bithynia tentaculata* (L.), *Lymnaea stagnalis* (L.), *L. peregra* (Müller) and *Valvata cristata* Müller. *Planorbis crista* (L.), *P. contortus* (L.) and *Bithynia leachii* (Sheppard) were frequently met with. *Sphaerium lacustre* (Müller), *Planorbis albus* Müller, *P. planorbis* (L.), *P. vortex* (L.), *P. carinatus* Müller, *P. vorticulus* Troschel, *Segmentina complanata* (L.), *Aplexa hypnorum* (L.) and *Valvata macrostoma* Steenberg were found but rarely. Kuiper says: " Characteristic elements of the biotopes inhabited by *P. pseudosphaerium* are *Planorbis vorticulus* Troschel and *Sphaerium corneum* var. *nucleus* Studer." I found *P. vorticulus* in only two localities and *S. corneum* var. *nucleus* in only one. *Valvata macrostoma* was also extremely rare. I never found *Potamopyrgus jenkinsi* (Smith) in association, although it is in the list of Mollusca taken by Mr. A. E. Ellis included in Kuiper's paper.

P. subtruncatum.—The most abundant *Pisidium* in Waterlot Stream, the stream south of Hooe and other streams with good flow. The typical form of the species was only rarely met with, most specimens being quite small with not very prominent umbones, and in many cases it was difficult to separate them from some forms of *P. casertanum*. The cardinals C_2 and C_4 were much shorter than is usual for this species in the majority of specimens examined. It is interesting to note that of ten gatherings from the small unnamed stream south of Hooe, *P. subtruncatum* was present in all and was the dominant *Pisidium* in each case.

The table sets out the distribution of species in the stream in descending order from a point near its source (dredgings further upstream yielded no Mollusca at all) to a point near its junction with a large marsh drain. There is a very good flow throughout this stretch, especially near the source, becoming rather slow towards its junction with the drain.

Records based on dead shells only (one specimen in each case) are shown thus *. The single dead *P. nitidum* in locus 1 and the *P. personatum* in locus 2 are almost certainly adventitious, probably washed in during flood. *P. nitidum* in locus 3 and *P. amnicum* in locus 4 are represented by single individuals in each case. In locus 5 *P. amnicum* and *P. pulchellum* are represented by single shells only and *P. nitidum* by two. It is not until locus 6 is reached that species other than *P. subtruncatum* are at all

Locus	Nature of Stream Bed	*amnicum*	*personatum*	*milium*	*subtruncatum*	*henslowanum*	*hibernicum*	*nitidum*	*pulchellum*
1	Grit. No weed				x			*	
2	Gravel and grit. No weed . .		*		x				
3	Tenacious clayey mud. No weed .				x			x	
4	Fine mud. No weed . . .	x			x				
5	Soft brown mud. Little weed . .	x			x			x	x
6	Soft red mud. Little weed . .			x	x		x	x	x
7	Soft red mud. Weedy . . .	x		x	x	*	x	x	x
8	Soft red mud. Weedy . . .			x	x		x		
9	Soft red mud. Very weedy . .	x		*	x	x	x		x
10	Soft red mud. Very weedy . .	x		x	x		x		x

numerous, *P. hibernicum* being especially well represented here, and most specimens, including *P. subtruncatum*, are quite large. *P. hibernicum* are numerous in the remaining loci and the *P. pulchellum* are very fine in locus 10. *P. henslowanum* is represented by one dead shell in locus 7 and a living example in locus 9. It is obviously not very happy here and I did not find it elsewhere in the district. Though it would be unwise to draw conclusions from such a small survey, it is interesting to note the coincidence of the sudden appearance of species with the presence of weed and soft vegetable mud on the stream bed, and the marked abundance of *P. hibernicum* from locus 6 onwards is especially noteworthy, locus 10 producing the finest examples from this stream. The *P. amnicum* were finest in locus 7. The abundance of *P. subtruncatum* in each locus is curious, and Alkins (1925) had similar results from streams in the Oakamoor district of Staffordshire. In his excellent paper on Scottish and Shetland Pisidia, Oldham (1932) expressed the conviction that the nature of the bottom of the lochs in which he dredged " was the determining factor in the occurrence of some, and the relative abundance or scarcity of other species " and not the alkalinity or acidity of the water.

Further research would be desirable to determine just how species are affected by their environment having regard to factors other than pH and calcium content. Such essentially mud-dwelling animals as *Pisidium* are, perhaps, affected much more by the medium in which they move than by the waters above.

P. henslowanum.—One dead and one living specimen found in the stream south of Hooe, both quite large but thin. Obviously not a good habitat. This species likes waters with at least a moderate amount of calcium carbonate in them, and I was quite surprised that it turned up at all in the area.

P. hibernicum.—Plentiful in Waterlot Stream, stream south of Hooe and ditch with flow at Pevensey. In many ways these are unusual *P. hibernicum* and their relative abundance where they occurred suggested a form of *P. nitidum.* Externally they are extremely glossy, a marked character of *P. nitidum*, and for a long time I could find no pores in any specimens, likewise a *P. nitidum* characteristic. Subsequently, however, their true identity was established, for some very porous examples were found and several very ventricose specimens with pronounced, striate umbones turned up. Moreover, two young I obtained from one example proved to be typical *P. hibernicum* fry. This constitutes a new record for Sussex East (*J. Conch.* **24**, 151), the earlier record being of doubtful provenance.

P. nitidum.—Occurred sparingly in Waterlot Stream, stream south of Hooe and was plentiful in a pond at Herstmonceux. Mostly very poor thin forms.

P. pulchellum.—Fine specimens were taken in Waterlot Stream and adjacent drain, and stream south of Hooe. Single specimen found in ditch with flow at Pevensey.

The Pevensey Levels district is so interesting that I feel an attempt should have been made to collect both land and freshwater shells besides *Pisidium*, but by the time I realized how fruitful the area was I had to move away from it. It is hoped, therefore, that these notes may stimulate others to collect in the area and, perhaps, in similar marshy places in the South of England.

For checking my determinations I am indebted to Mr. A. W. Stelfox and Mr. A. E. Ellis. Mr. Stelfox, besides identifying specimens, gave much helpful advice which is largely incorporated in this paper, though I alone am responsible for the conclusions set down.

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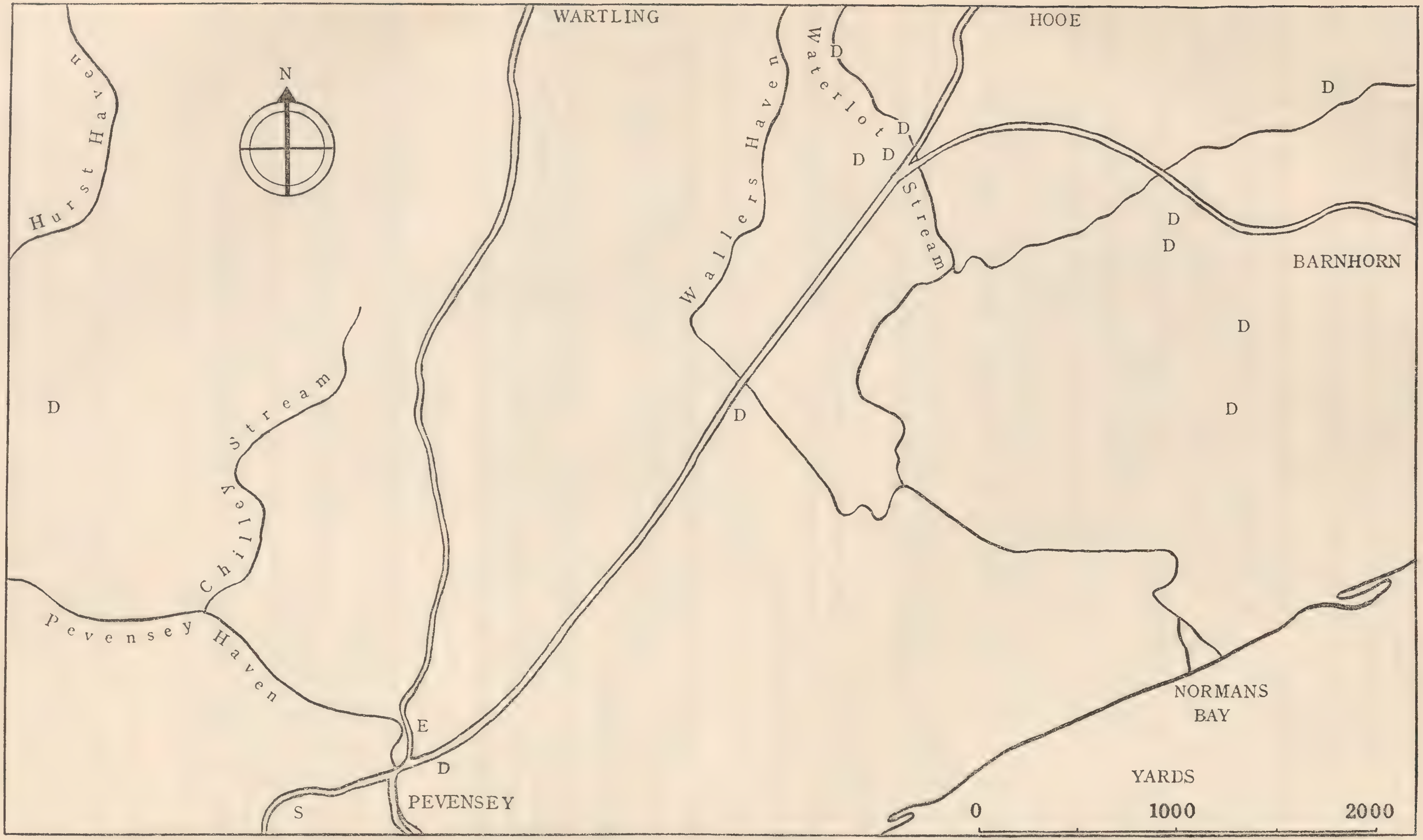


Distribution of *Pisidium pseudosphaerium* at Pevensey. S : Stelfox, 1911. E : Ellis, 1927. D : Dance, 1955.

AGE DETERMINATION IN *ANODONTA*

By T. E. Crowley

(*Read before the Society,* 15 *December* 1956)

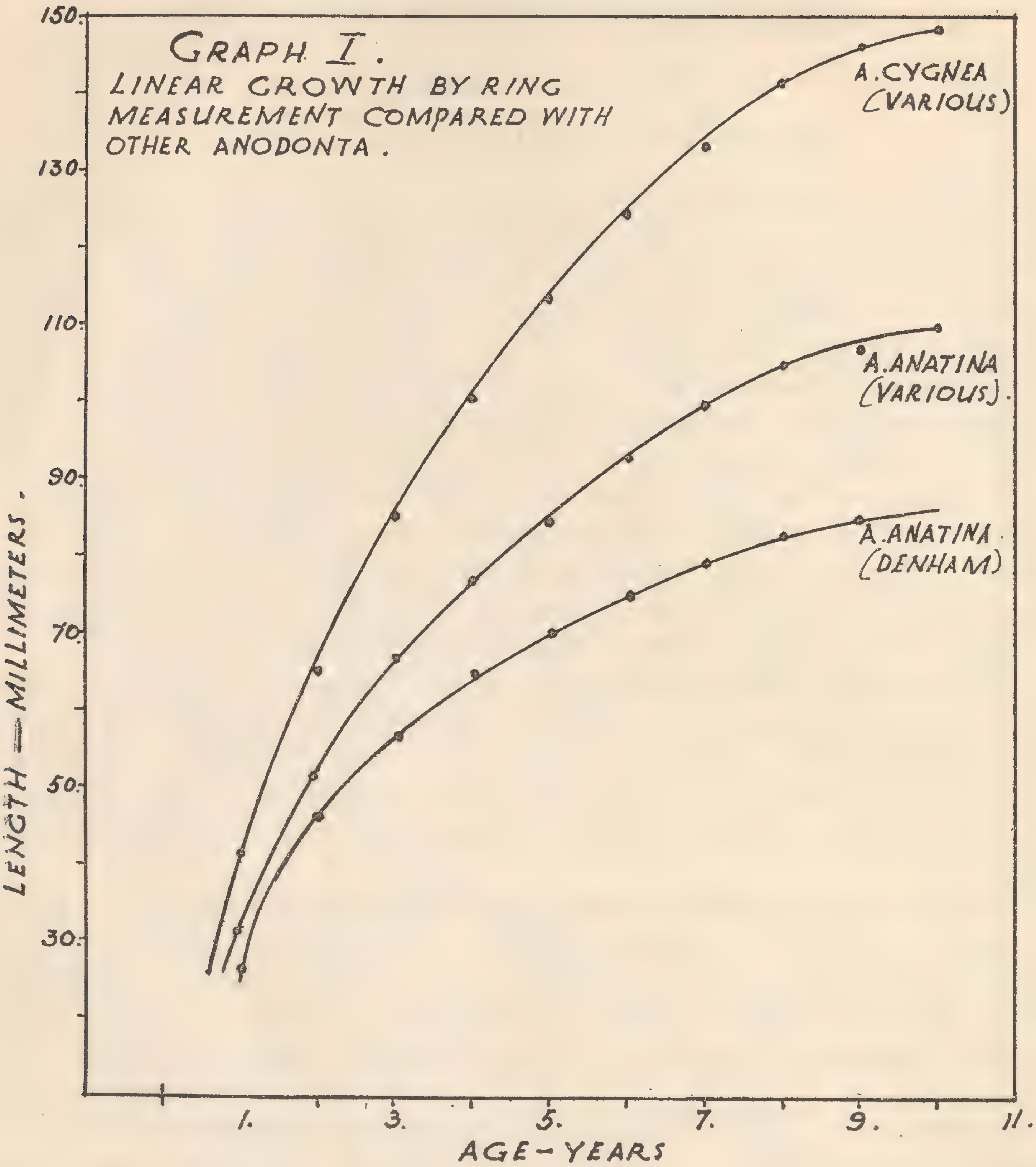
Most bivalves grow in size throughout life, and many possess a series of dark lines extending circumferentially from the umbones and following the shape of the shell in a fashion which suggests that they represent stages in the growth of the mollusc; they have in fact been termed "winter rings". They appear to be caused by the thickening of the periostracum and when this is removed they can still usually be traced by slight puckerings in the surface of the shell. Their relationship with growth is further suggested by the fact that any comparative measurements taken on the two valves of a shell invariably show identical or almost identical results, and moreover, the segment of shell added between rings is always a gnomon to the rest, that is to say, it increases the size of the mollusc without altering the shape. It would appear that the dark lines are laid down at regular stages of growth.

The notes that follow attempt to analyse this pattern of growth in the case of one species, but the conclusions might be regarded as of more general application. *Andonta anatina* (L.) was the species chosen for two reasons: first that it is known to be variable in its size and shape, and second that a good quantity of material was available for study purposes.

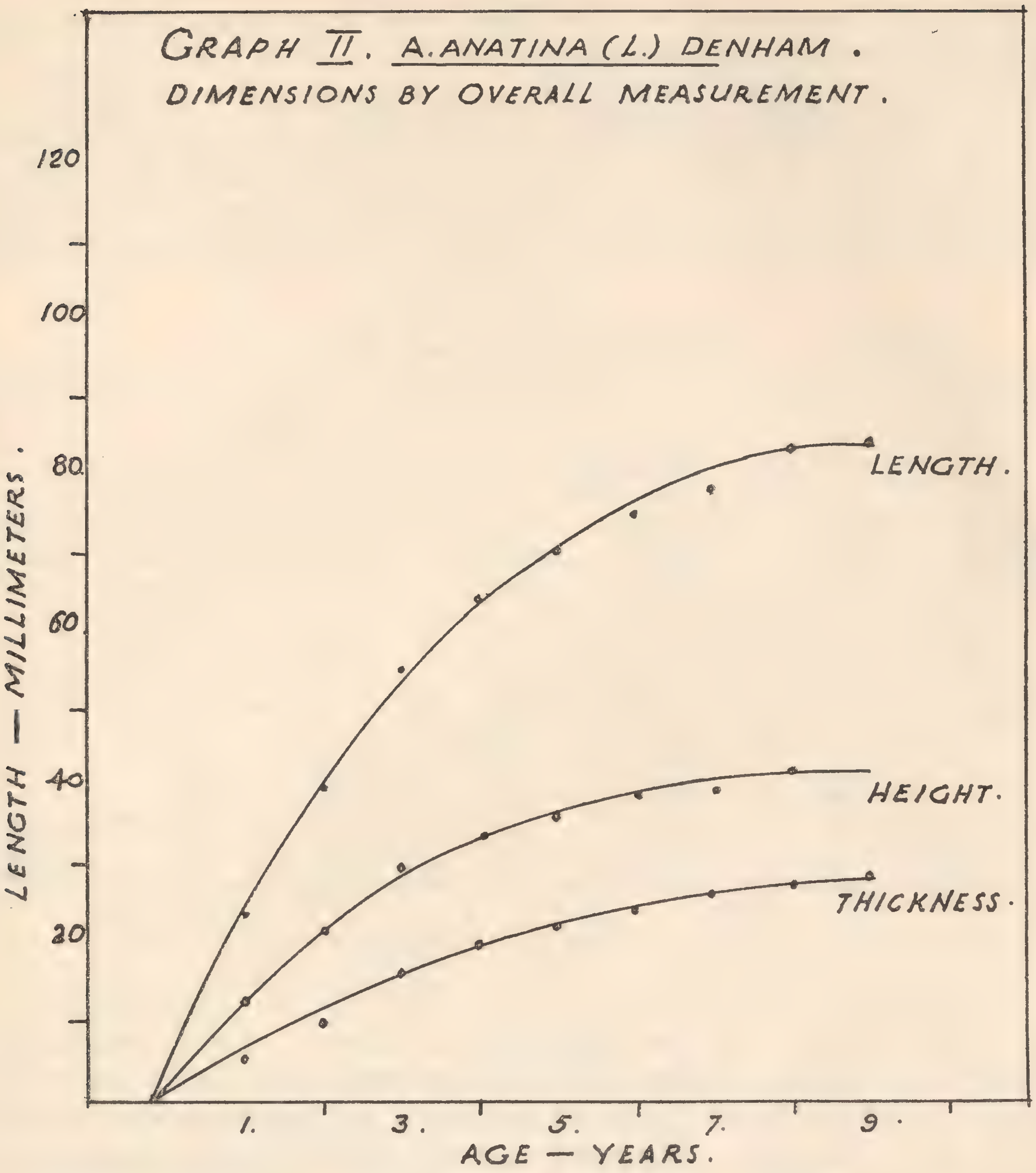
Anodonta anatina was for many years confused with its related species *A. cygnea* (L.) and *A. minima* Millet, and it appears that it was not without trouble that the three species were differentiated. Forbes and Hanley were emphatic about the existence of only a single British species; Montagu, Turton and Gray all agreed with this finding. This may perhaps be taken as good evidence of individual variability, and an examination of a good number of specimens demonstrates that this variability is not solely a response to locality in the broad sense, since widely differing shapes may be taken in a few square yards of river bed, but seems to be a sensitive response to the microhabitat in the immediate vicinity of the shell (exact depth, type of bottom, light values, currents, surrounding vegetation, commensals, etc.) and is, partly at least, a basic characteristic of the species. The fact reduces the possibility of an investigator being misled by statistical information, since irregularity of growth tends to eliminate coincidental results.

This study mainly concerns approximately two hundred specimens of *A. anatina* dredged from the River Colne at Denham, April 1955, which were therefore almost all alive. Results, however, have been checked with a number of shells obtained in June 1956 from the same locality, which had died naturally, and with shells from other places. Brief studies were also made with *A. cygnea.*

It may be supposed that the dark lines on the shells indicate for the most part recurring cycles of growth, in much the same way as annular rings on tree trunks which are known usually to occur at yearly intervals. The season of the year is obviously the predominating factor in the

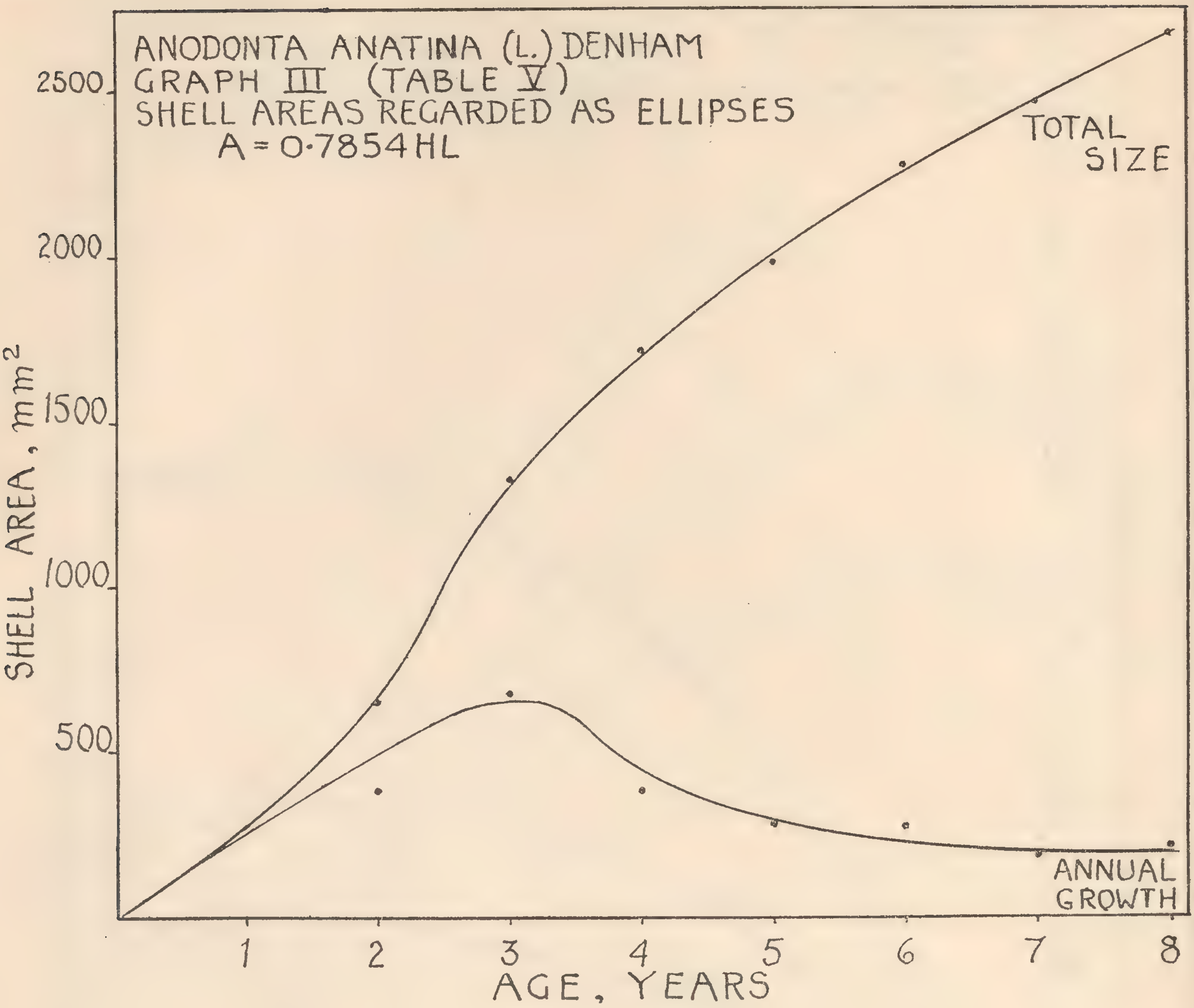


study of growth of all kinds and the possibility that lines on shells indicate years of age is strong. At the same time it can be observed that growth lines are of two types—those occurring at regular intervals and a fainter interposed kind, observable on only a few shells and often incomplete, which may be termed " disturbance lines " and appear attributable to a change in conditions of living which causes a check of growth. Such a change does not appear to occur very frequently in the case of *Anodonta*, but may be due to such factors as transport by floods or pollution. In some cases, also, it appears that two rings may be laid down in a winter, one ring being much the fainter. In the analysis of ring measurements the fact that some of these markings may occur strongly enough to be confused with winter rings must be considered, but if this were so to any appreciable extent in the present analysis the statistical results would be likely to show anomalies which are not in fact observed. This statement does not hold true with every genus; Winckworth in the case of *Paphia undulata* (Born) concluded after plotting that winter rings were



masked by disturbance rings, and quotes other instances. *Paphia*, however, is thought to live less than two years.

In the case of *Anodonta*, as with many other molluscs, the border of the mantle incorporates a groove consisting of secretory epithelium which is responsible for producing the periostracum. A narrow strip of mantle behind this groove secretes shell material, depositing it in a layer below the periostracum. Protection of the edge of the shell is thus ensured, as there is no gap between the periostracum and the mantle edge when the shell gapes, or between the periostracum and the meeting point of the valves when the shell is closed. Secretion of the periostracum occurs at a rate which appears very little affected by the season, while the shell itself grows rapidly at certain times and practically not at all at others. Hence, during periods of rapid shell growth the periostracum is laid down as a comparatively thin covering and when growth is slow the surplus secretion of periostracum causes overlapping and puckering on a small scale and, particularly near the beaks, a certain amount of incorporation occurs and a line of growth is the result.



The statistical survey was conducted as follows: the *A. anatina* were collected during the course of dredging operations which were being carried out on the River Colne by means of a dragline at grid reference 042889, O/S Map 160. The fact that the whole bottom surface of the river was removed over about 200 yards length assisted the possibility of obtaining a completely random sample and collecting was done with this in mind, although such samples are almost impossible to procure in practice. *Unio pictorum* and *Anodonta minima* were also collected but are here comparatively rare.

Specimens were then measured with dividers. Measurements taken in each case included overall length, height over umbones and thickness, and past lengths as indicated by each growth line. All measurements were taken to the nearest millimetre.

The habits of growth revealed by analysing these figures, considering the variability of the species, showed very consistent results. The linear measurements between successive rings showed a steady and consistent decrease, and although this was not observable in the case of every individual specimen, there was no trace of any regular fluctuation such as would be present if rings were added at the rate of two or more per year, an arrangement which would certainly produce two or more distinguishable rates of growth per year. The *Anodonta* almost all died within a few days and thus provided the data which would have tended to show up fluctuations of this kind, had they been present. In the case of the oyster and other molluscs, it has been established that growth takes place for a few weeks during the spring and again in the autumn when spawning is complete, being negligible at other times. No trace of this habit is observable with the river mussel; it is more likely, as with many marine lamellibranchs, that growth occurs when the water is above a given temperature and stops completely below this limit.

TABLE I

Anodonta anatina, Denham

Age in years by ring count	Lengths by Ring Count		Dimensions by Overall Measurement			
	No. of measurements	Average length in mm.	No. of measurements	Average length in mm.	Average height in mm.	Average thickness in mm.
1	202	25·9	1	24	13	5
2	201	46·0	4	39·3	21·2	11·5
3	197	56·7	15	55·4	29·8	16·5
4	181	64·5	85	64·0	33·7	19·5
5	96	70·0	57	70·0	36·2	22·0
6	39	75·2	15	75·8	38·4	24·0
7	25	78·9	15	77·5	39·7	26·0
8	9	82·9	8	83·6	42·5	27·0
9	1	84·0	1	84	39	28·0

INCREMENTS IN SIZE BETWEEN SUCCESSIVE RINGS

TABLE II

Anodonta anatina, Denham

(Number in Sample : 197)		(Number in Sample : 25)	
1st to 2nd	20·1 mm.	Last to last but one	6·0 mm.
2nd to 3rd	10·7 mm.	Last but one to last but 2	6·5 mm.
3rd to 4th	6·8 mm.	Last but 2 to last but 3	8·8 mm.
4th to 5th	5·5 mm.	Last but 3 to last but 4	8·4 mm.
5th to 6th	5·2 mm.	Last but 4 to last but 5	10·4 mm.
6th to 7th	3·7 mm.	Last but 5 to last but 6	12·0 mm.
7th to 8th	4·0 mm.		

TABLE III

Anodonta cygnea, various localities

(Number in Sample : 18)

1st to 2nd	23·5 mm.	6th to 7th	9·0 mm.
2nd to 3rd	20·5 mm.	7th to 8th	8·0 mm.
3rd to 4th	15·5 mm.	8th to 9th	5·0 mm.
4th to 5th	12·0 mm.	9th to 10th	2·0 mm.
5th to 6th	11·0 mm.		

TABLE IV

Anodonta anatina, Denham

Ratios of the three main dimensions

Ratio	Year 1	2	3	4	5	6	7	8
$\frac{\text{Height}}{\text{Length}}$.	·54	·54	·54	·53	·52	·51	·51	·51
$\frac{\text{Thickness}}{\text{Length}}$.	·21	·29	·30	·30	·31	·32	·33	·32
$\frac{\text{Thickness}}{\text{Height}}$.	·39	·54	·55	·58	·61	·63	·66	·64

It will be seen from the tables that successive increments show a progressive decrease which could only be the case if these increments were annual, since they cannot accrue at a rate of less than one per year. The conclusion is that the rings denote the winter boundaries of successive annual amounts of growth.

In addition to ring measurements, total dimensions in all three planes were recorded. Analysis confirms that linear growth takes place at a continually declining rate throughout life in all three dimensions. The mean variations decrease with advancing age, which indicates a decreasing response to environment; further, as seen in Table IV, there is a marked tendency for the thickness of the mollusc to increase relatively throughout life, although most of this relative increase occurs during the first two years. The same tendencies are observable in the case of *Anodonta cygnea*, but growth is more rapid at all stages.

An attempt was then made to translate the data obtained on linear growth to provide an indication of the area of shell added year by year. This was done by considering the shell as a regular ellipse of axis measurements equal to the length and height of the shell. This must necessarily be a rather rough approximation, and takes no account of the increase in thickness, and hence of the shell weight added yearly. However, by using the formula for elliptical areas ·7854 LH we get a set of results as follows :—

TABLE V

Anodonta anatina (L), Denham

Annual increase in shell area (mm^2.)

	Year 1	2	3	4	5	6	7	8
Elliptical area of one shell . . .	264	649	1,327	1,707	1,990	2,268	2,460	2,672
Increase in area .	264	385	678	380	283	278	192	210

This table shows a rate of growth which rises to a maximum in the third year, by far the most vigorous period in the life of the mollusc. When this table is plotted (Graph III) it is seen to produce the well-known S-curve typical of nearly all forms of growth from that of yeasts to that of the human species (D'Arcy Thompson).

The average life of *Anodonta anatina* in the Denham district is about five years and the oldest specimen found indicated nine seasons. This seems typical of the Thames valley, where no specimen older than nine years or longer than 95 mm. has been examined. In Nottinghamshire, where specimens of 130 mm. are common, the average age is slightly higher, 10–11-year mussels being found. Growth here is, however, greater at all stages and the dimension ratios are quite normal. *A. cygnea* on brief analysis provided analogous results and a similar maximum age.

Attention may be drawn to a cognate study on a marine bivalve recently published by Green (1957).

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WINCKWORTH, R., 1931. Growth of Paphia. *Proc. Malac. Soc.* **10**, 171–4.

***Edouardia herbigrada* (Pilsbry) in Uganda.**—Early in 1955 Mr. W. Wilkinson, of the Colonial Termite Research Unit, made a small collection of Mollusca during his search for termites in Uganda and the Sudan. All the specimens were found æstivating in dead wood or hollow twigs, and comprise species of *Trochonanina*, *Vitrina*, *Helicarion* and Pachnodidae. I have not named much of this collection yet, since comparison is needed with types in European museums. One record, however, is of interest. A single specimen of *Edouardia herbigrada* (Pilsbry, 1919, *Bull. Amer. Mus. Nat. Hist.* **40**, 308, fig. 157) was found in a dead branch 33 miles from Masindi on the Atura road, Uganda, at an altitude of 1,200 metres, on 19 February. The species was originally ascribed to *Pachnodus* and described from specimens collected at Faradje, Belgian Congo, in hollow twigs ; I have traced no other record. In the collection from a different locality are two other species of *Edouardia* (juvenile) which, although easily confused with *E. herbigrada*, have a much more elongate form and less reflected columella. The specimen is in the Coryndon Memorial Museum, where the writer is building up collections of East African Mollusca.

B. VERDCOURT.

(*Read before the Society*, 15 *December* 1956)

VERTIGO SUBSTRIATA (JEFFREYS) IN HERTFORDSHIRE

By L. Lloyd-Evans

(*Read before the Society*, 15 *December* 1956)

A single living specimen of *Vertigo substriata* was found on 21 November 1956 in dry leaf-litter from the roots of a fallen willow in a small plantation by the Spital Brook, opposite Hoddesdon Park Wood, Hoddesdon (National Grid 52/354081). Next day five more specimens were found within a radius of 10 feet of the original site, four on withered leaves of *Glyceria maxima* and one on the bark of a fallen willow.

The willow plantation is on Tertiary Clay at the foot of the southern slope of the valley of the Spital Brook. Higher up the slope is a thick bed of Tertiary Pebble Gravels, and water percolating through the gravel issues as springs at the upper edge of the plantation. The lower part of the plantation is marshy, with a few inches of standing water in winter, and a ground flora dominated by *Glyceria maxima*, with *Epilobium hirsutum* and *Scirpus sylvaticus*. On less waterlogged ground higher up are *Viburnum opulus*, *Cirsium palustre* and *Urtica dioica*.

The commonest associated Mollusca were *Succinea putris*, with lesser numbers of *Carychium tridentatum*, *Cochlicopa lubrica*, *Helix nemoralis*, *Hygromia hispida*, *Punctum pygmaeum*, *Discus rotundatus*, *Arion intermedius*, *A. circumscriptus*, *A. subfuscus*, *Euconulus fulvus*, *Vitrea crystallina*, *Oxychilus helveticus*, *Retinella radiatula*, *R. pura*, *R. nitidula*, *Agriolimax reticulatus*, and *A. laevis*.

Vertigo substriata has previously been found in Hertfordshire only in Holocene deposits at King's Langley and Wilstone (*Trans. Herts Nat. Hist. Soc.* **22**, 10, 16).

A further note on *Lymnaea stagnalis* (L.) in Anglesey.—The Stelfox collection, now in Liverpool Public Museums, contains a set of *L. stagnalis*, comprising four specimens (the largest 33 mm. in height), together with a few *L. peregra*, from Afon Cefni, Anglesey, 9 October 1920. Mr. A. W. Stelfox informed me that the exact locality was the embanked River Cefni close to Malldraeth Yard, on the west side of the island. *L. stagnalis* is evidently not so uncommon in Anglesey as Boycott (*J. Anim. Ecol.* **5**, 156) supposed, for now four localities are known, the other three being Llyn Maelog, Llyn Coron and Llyn Llywenan (*J. Conch.* **24**, 101).

N. F. McMillan.

(*Read before the Society*, 17 *November* 1956)

NOTES ON DIXON AND WATSON'S "DESCRIPTIVE MANUAL OF BRITISH LAND AND FRESH-WATER SHELLS"

By Mrs. N. F. McMillan

(*Read before the Society*, 16 *March* 1957)

Tomlin (1945) gave some details of this little book, and these notes are merely supplementary to his. There appear to be at least three different versions of the book, varying slightly, and including what is apparently one expressly designed for the American market. I have examined the following :—

(*a*) A quite ornate blue cloth cover, stamped in gold " Land and Fresh-Water Shells ". The title-page reads : " A Descriptive Manual of British Land and Fresh-Water Shells, containing Descriptions and Figures of all the Species, by Dixon and Watson. Printed for Dixon and Watson, Ayton School, near Stokesley. Darlington. Harrison Penney, Printer, Prebend Row, 1858." Eight col. plates. Mr. Tomlin gave me this in 1944.

(*b*) Brown paper cover, worded : " Dixon and Watson's Descriptive Manual of British Land and Fresh-Water Shells with Plates of all the Species, and Genera of Animals. With Catalogue appended, giving all the New Species and Varieties. Price Two Shillings and Six Pence. The Cleveland Natural History Depot, Great Ayton, Yorkshire. George Dixon, Sen., Manager. See Priced Catalogue at end of Book." Title-page exactly as (*a*). Eight plain plates. In the List of Species one notes " *Helix pulchella* v. *costata* Dixon, *Limneus pereger* v. *acuta* Dixon, and *Carychium minimum* v. *subedentulum* Dixon. The catalogue is headed " The Cleveland Natural History Supply Depot ". The Priced Catalogue lists natural history books, catalogues, collections, and collecting apparatus generally. Among the books is a " Shell-Collector's Hand-Book, interleaved, price 4/6 " (no author's name given). This I have failed to trace. In the catalogues offered is " Jeffrey's Catalogue of British Mollusca, containing both Marine (Sea) Shells and Land and Fresh Water Shells, pamphlet form 1*s*. 4*d*.". Also list of the above, in sheet with prices of each species, 6*d*. Neither of these is given in Tomlin's " Lists of British Shells " (1944). The apparatus offered includes such items as a shell-spoon for dredging and a Conchological Kettle for boiling shells.

The collections section offers collections of all sorts of natural history things, British land and freshwater shells (with copy of Dixon and Watson's Manual) costing 7*s*. 6*d*. for 50 species and 25*s*. for 100, and British marine species about the same. Collections of American species are also for sale, collected by George Dixon when in America, 25 species for 5*s*. 6*d*., 50 for 10*s*. 6*d*., and 75 for 15*s*. 6*d*.

(*c*) Brown paper cover, titled : " Dixon and Watson's Descriptive Manual of British Land and Fresh water Shells, with Plates of all the Species, and Genera of Animals. Price, 50 Cents." Title-page as cover, except that Harrison Penney, Darlington, is still the printer, and the date is again 1858. Eight plain plates. This version contains the List of

British Land and Freshwater Mollusca, but no Catalogue. However, on the back cover collections of British shells are advertised, and also the Manual (as (*c*)) to be had from S. E. Cassino, Naturalists' Agency, Salem, Mass. I have only seen one example of the last version, which is in my possession.

One curious point is that this book is described by Kennard & Woodward (*Synonymy of the British non-marine Mollusca*, p. 375) as being octavo, yet the advertisement of the American version says duodecimo.

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TOMLIN, J. R. le B., 1944. Lists of British Shells. *J. Conch.* **22**, 114–8.
—— 1945. Book Notes, No. 23. *Proc. Malac. Soc.* **26**, 90.

GLYPTEUTHRIA CAPENSIS : A GENERIC CORRECTION

By K. H. BARNARD

(*Read before the Society*, 16 *March* 1957)

TOMLIN described *Glypteuthria capensis* (1931, *Ann. S. Afr. Mus.* **30**, 165) from specimens in the South African Museum, one of them with its operculum. In 1945 (*J. Conch.* **22**, 135) he substituted the name *sculpturata* because Thiele had already used the same combination (1925, *Deutsche Tiefsee Exp.* **17**, 179). Although the smallest specimen in the South African Museum collection (not submitted to Tomlin) is nearly twice as large as the " Valdivia " specimen, comparison of its upper whorls with Thiele's figure (pl. 31 (19), fig. 27) leaves no doubt as to its identity.

When cataloguing the South African Museum collection many years ago I had placed these shells near *Fusivoluta pyrrhostoma* (Watson), which they closely resembled except for the stronger sculpturing. Unfortunately no animal was submitted to Tomlin. I have now examined the radula and find it is indistinguishable from that of *F. pyrrhostoma*, of which there are also examples in the South African Museum. The correct name of the species, therefore, is *Fusivoluta capensis* (Thiele). Tomlin's description stands, but the species grows to a larger size than the type, viz. : 38 × 15 mm., aperture 17 mm.

Both species occur off Cape Point and the west coast of the Cape Peninsula : *pyrrhostoma* living at 145–200 fathoms, *capensis* living at 250–560 fathoms. The " Valdivia " locality is consistent : 35° 9′ S. 18° 33′ E. 564 metres.

Glypteuthria solidissima Tomlin, 1931, must remain in this genus until living material is obtained. It is certainly far more like a Buccinid than *capensis*.

A MOLLUSCAN FAUNA FROM ALLUVIUM OF THE NEW RIVER AT CANONBURY, NORTH LONDON

By M. P. Kerney

(*Read before the Society*, 19 *January* 1957)

The New River was constructed by Sir Hugh Myddelton in 1609–13, between the chalk springs at Chadwell and Great Amwell, Hertfordshire, and the New River Head at Islington, to provide the Metropolis with a clean water supply. Until about 1800 Islington remained a village and the New River traversed open country throughout its winding course of, originally, some 38 miles. During the first half of the nineteenth century Islington, Canonbury and Highbury became rapidly built over and finally, by the 1860s, the New River in this area was put into a tunnel below ground.

The discovery of a subfossil molluscan fauna, of eighteenth or early nineteenth century date, in alluvium of the New River at Canonbury, is of interest as representing an assemblage, introduced in the first place through the agency of man, which could not to-day be found living in Inner London. Recently Mr. Frank Berry showed me some *Viviparus* which he had found in Canonbury Grove, a turning off Canonbury Road. The New River flowed in the slight depression between Canonbury Grove and Alwyne Road, its site now being taken by a small public garden with a line of ponds marking the former course. Bleached freshwater shells, in a matrix of stiff, silty clay, occur abundantly in the dark soil seen in the flower-beds, and the following were the result of an afternoon's collecting:—

Theodoxus fluviatilis, *Viviparus viviparus* (abundant, some containing broods of young shells), *Valvata piscinalis*, *Bithynia tentaculata*, *Carychium minimum*, *Lymnaea auricularia*, *Planorbis albus*, *P. crista*, *Acroloxus lacustris*, *Cecilioides acicula* (a later introduction into the deposit), *Unio tumidus* (common), *Pisidium amnicum*, *P. casertanum* (thickened form), *P. henslowanum*, *P. nitidum*, *P. moitessierianum*, *Dreissena polymorpha*.

Molluscan conditions were excellent; the water was clear, weedy and slowly moving. The presence of typical calciphiles such as *Theodoxus fluviatilis*, *Unio tumidus* and *Pisidium moitessierianum* in this lime-deficient London Clay area is plainly due to the chalky spring waters flowing from Hertfordshire. An interesting find was *Dreissena polymorpha* (two valves). The species was first recorded in Britain, in the lower Thames, in 1824 by J. de C. Sowerby (*Trans. Linn. Soc.* **14** (1825), p. 585), and appears subsequently to have become common about London, but it does not seem to have been specifically recorded from the New River until 1862, when Jeffreys stated that it abounded there (*British Conchology* **1**, p. 48). Daniel Cooper in 1836 (appendix to *Flora Metropolitana*) gives five species for the New River, including *Viviparus viviparus* and *Unio tumidus* (?), but not *D. polymorpha.*

Most, perhaps all, the species listed still live in the upper reaches in Hertfordshire, but the southward migration of Mollusca into London is now prevented by filter beds. The clogging of water-mains in Oxford Street by *D. polymorpha*, as related by Jeffreys, could not occur to-day.

Associated with the freshwater Mollusca at Canonbury were shells of oyster and *Littorina*, bones of ox, sheep and pig, and clay pipes of late eighteenth or early nineteenth century patterns.

Large *Planorbis vorticulus* Troschel near Pevensey, Sussex.—While collecting freshwater Mollusca from a marsh drain on the Pevensey Levels near Normans Bay on 22 July 1956, I took six large examples of *Planorbis vorticulus*. The largest of these measured 7·4 × 1 mm. Ellis (1926) gives a measurement of $3\frac{1}{2}$–5 mm. diam. and under 1 mm. in height for this species. I have collected *P. vorticulus* from other drains on these marshes but none of them exceed 5 mm. diam. It would seem as though conditions must have been exceptionally favourable for growth, but unfortunately I was unable to make observations on the nature of the habitat.

S. P. DANCE.

Types of *Cypraea lynx* var. *williamsi* Melvill. The types (two specimens) of this variety have recently been presented to Liverpool Public Museums by Miss Marion Williams, daughter of J. M. Williams after whom the variety was named. Miss Williams also presented what is almost certainly a paratype of *Olivella williamsi* Melvill & Standen.

N. F. McMILLAN.

REVIEW

Liver-fluke Snails in Britain. ALAN MOZLEY. Pp. xi, 55, 11 illustrations. London: H. K. Lewis and Co., Ltd. 9*s*.

DR. MOZLEY'S purpose in this excellent little book is to give veterinarians, agricultural advisers and farmers, in non-technical language, the information necessary to recognize the kinds of site occupied by *Lymnaea truncatula*, the snail vector of the liver-fluke, how to identify it and how to destroy it *in situ*. He refers to the great damage inflicted year by year on sheep and cattle, even when there is no catastrophic epidemic. While appreciating the limited value of treating infected animals, the method chiefly adopted hitherto, he stresses the much greater and more permanent value of treating the snail sites, which is cheaper in the long run. Detailed directions for this treatment are given, and the photographs give a good indication of where to look for the snails. This book should be of great service to all who have to contend with liver-rot disease in animals.

H. E. QUICK.

OBITUARY

J. F. BENSLEY, 1894–1955

LT. COL. CYRIL JOHN FRANK BENSLEY died on 29 September 1955 at the age of 61. He was educated at a preparatory school in Eastbourne and at Cheltenham College, from which he passed into the Royal Military Academy, Woolwich. Commissioned into the Royal Artillery, he served during the 1914–18 war in France, Italy and Mesopotamia. After the war he was a liaison officer for a time at Constantinople. He served overseas for most of the inter-war period and was stationed for some time in Hong Kong and Singapore. In the early days of the 1939–1945 war he acted as interpreter at Gibraltar between French and English naval detachments. Ill-health prevented his going on fighting service in the army, but he was able to do excellent work in the artillery training camp at Devizes. He resigned his commission in 1948 and retired to live with his mother at Hindhead, near Haslemere, Surrey.

Bensley had been interested in natural history from childhood and he continued to collect and observe wherever opportunity allowed during his travels with the army. His interests were wide, but he specialized in Mollusca, joining the Conchological Society in 1935 and becoming a life member. He joined the Malacological Society in 1934, serving on its Council from 1943–45 and from 1950–51, being Vice-President from 1946–49. Although he attended meetings of both societies whenever he was in London, he appears to have contributed only one short note to their publications, viz., " *Lymnaea stagnalis* (L.) killed by radular action," *J. Conch.* **23,** 61, 1949.

In 1946 he joined the London Natural History Society and at once took part in the Society's natural history survey of Bookham Common, Surrey. Here he studied the Mollusca, especially the aquatic species and their population changes, and made observations on the mammals, birds, Lepidoptera and aquatic insects. He was one of the most constant, enthusiastic and popular members of the survey team, visiting the common on almost every one of the monthly meetings from early 1946 until July 1955. The results of his work appeared in the *London Naturalist*, in three papers : " Fresh Water Mollusca of Bookham Common," 1948, No. 27, 51–5 ; 1952, No. 31, 34–9 ; " The Fresh-water Mollusca of the bomb-craters and gun-pits on Bookham Common," 1955, No. 34, 22–8. He also took part in the Society's survey of the City bombed sites and contributed a short note on the Mollusca, 1952, *L.N.* No. 31, 83–4.

After retiring to live at Hindhead he took part wholeheartedly in the activities of the Haslemere Educational Museum and of the Haslemere Natural History Society. In 1949 he acted as Deputy Curator of the Museum, between the resignation of one curator and the appointment of a successor, and in 1950 he was elected to the Committee of Management and appointed Hon. Entomologist and Conchologist. Bensley was very popular with children and had a gift of arousing interest in natural history among them, taking many parties of children round the museum. In 1954 he was asked by the Museum Committee to take charge of tours arranged by the London County Council for children from London schools. Between 1948 and 1954 he overhauled and rearranged the museum's large collection of shells and completed a new exhibit of Mollusca.

Bensley was elected President of the Haslemere Natural History Society in February 1952 and remained in office until his death. Since 1950 he had organized an ecological survey of the Devil's Punch Bowl, Hindhead, and directed the work with great enthusiasm. His preliminary report, "The Natural History of the Devil's Punch Bowl," was published in 1954 (66th *Ann. Rep. Haslemere Nat. Hist. Soc.* Portrait in 68th *Ann. Rep.*).

C. P. CASTELL.

A. G. DAVIS, 1892–1957

OUR former President, Arthur George Davis, died peacefully in sleep at his home at Anerley early on 1 March 1957. Davis was born in Maple Road, Anerley, on 14 March 1892, his grandfather being a builder who had moved to the district many years before, in connection with the building development arising from the popularity of the Crystal Palace. His only formal education was received in the village school at Beckenham, which he left at an early age to become a carpenter in the family trade. As a child he quickly developed an intense love of natural history, furthered by his reading of such popular works as he could procure, such as the well known books of the Rev. J. G. Wood, of which he was very fond, and by collecting insects and plants in the fields around Elmers End, West Wickham and Keston, Coleoptera and Lepidoptera being his especial favourites. To the end of his life, in spite of his deep knowledge in so many branches of science, he remained a fine field-naturalist.

About 1908 some temporary exposures of shelly Blackheath Beds in Beckenham served to kindle his interest in geology and soon afterwards he attended meetings of the Croydon Natural History Society, where he met such geologists as G. J. Hinde and the veteran William Whitaker. The latter befriended Davis, helping him in many ways, giving him specimens and books and every encouragement to persevere. He always retained a great affection for Whitaker, "the first geologist I ever met." It is interesting to note that one of the books Whitaker suggested that he should read as a model of scientific reasoning written in lucid English was Kew's *Dispersal of Shells.*

During the 1914–18 war Davis entered the Royal Flying Corps and was stationed at Minster in the Isle of Sheppey, where he quickly availed himself of the opportunity to make detailed studies of the richly fossiliferous London Clay of the cliffs and foreshore. This work, which included an investigation of the microfauna, attracted the attention of Charles Davies Sherborn, who helped him (at first as an "anonymous benefactor") financially and otherwise, and an enduring friendship was formed. Sheppey was a place he never tired of revisiting in after years, and he published the full results of his work there in the *Proceedings of the Geologists' Association* in 1936. He became a leading member of the

Association, contributing many important papers to its *Proceedings*, conducting field-excursions and exhibiting regularly at the annual reunion.

Davis's knowledge of the Chalk and Tertiary rocks of S.E. England and their contained fossils was profound. A constant succession of papers on these deposits came from his pen, published in many journals, and all achieved in his very limited leisure. With Arthur Wrigley, he became our foremost authority on the English Tertiary, which had been largely neglected since the days of Prestwich. Of his writings in this field perhaps the most important was his joint paper with Wrigley in 1937 on " The occurrence of *Nummulites planulatus* in England, with a revised correlation of the strata containing it " (*Proc. Geol. Assoc.* **48**, 203–228), a fundamental work which altered current ideas both here and abroad on the correlation of the divisions of the Eocene. He collected extensively and with meticulous care, and that part of his material which he did not himself describe frequently served as the basis for monographs by specialists in particular groups. He also became very interested in the study of microfossils, and painstakingly acquired a first-rate knowledge of the Polyzoa and Foraminifera, which was later to stand him in good stead.

He always disliked the drudgery and uncertainties of the family business in which he was engaged, and in 1935, after a short period spent working at the Geological Survey, he entered the services of the Anglo-Iranian Oil Company as a micropalæontologist, already a noted authority in his own right. On his retirement in 1953 he joined the Foraminifera Section of the British Museum. A much fuller account of his professional geological activities, which included pioneer work on difficult groups of microfossils, such as the Radiolaria, will be found in his obituary in the *Proceedings of the Geologists' Association.*

Davis always possessed a good knowledge of British non-marine Mollusca, and so far back as 1921 he discovered an early Holocene tufa at Purley in the Croydon Valley, from which he carefully collected a series of shells, later identified by A. S. Kennard (*Trans. Croydon Nat. Hist. Sci. Soc.* **9** (1923), 6). The death of his close friend Kennard in 1948 determined him to take up the study of this group, which he did with his usual energy and enthusiasm. He rapidly made himself one of our leading authorities, becoming President of the Conchological Society in 1952, and his many papers in our *Journal*, both on living and fossil snails, added much to our knowledge and will remain as a monument to him. During these years he travelled extensively over southern England and discovered many new and often important Quaternary sections, from which he collected and examined the Mollusca, extracting these delicate and frequently minute fossils from his samples with characteristic patience and care. Those conducting archaeological excavations would send him the shells for report. Davis frequently said that he had enjoyed working at the non-marine Mollusca more than anything else he had done in his life and he spent innumerable happy hours in the field or in his " Shell Room " at Anerley engaged in their study. Unfortunately, much of what he achieved remains unpublished, or only half finished.

His knowledge of bibliography and of early geological and natural history literature was encyclopaedic, and was at the disposal of all who cared to ask for it. With but limited means, he amassed a superb library upon his favourite subjects, including many rare works on Mollusca, and of an evening he would often produce some freshly acquired treasure for inspection. He regarded books as being far more than mere dead sources of information; to him they were a delight in themselves and keys to bygone personalities, famous or forgotten.

His sudden and unexpected death came as a sad loss to his many friends. The writer had the great privilege of knowing Davis very well during recent years and received from him many kindnesses that will not soon be forgotten. The most unassuming of men, he was free from all pretence and intolerant of pretence in others. He was at any time ready to offer encouragement or help, especially to the beginner, and in the field he was the most delightful of companions. His cheerful and familiar figure at our meetings, which he enjoyed so greatly, will long be remembered.

The following is a list of Davis's writings on non-marine Mollusca published elsewhere than in this *Journal*. A complete bibliography of his papers will appear in the *Journal for the Bibliography of Natural History*.

1949. Note on Captain Thomas Brown's *Illustrations of the Conchology of Great Britain and Ireland*, 1827. *Proc. Malac. Soc.* **27**, 264.
1950. Holocene Mollusca from Waterloo, in Reports on temporary Geological Sections. *London Naturalist*, no. 29, 40–2.
1951. Holocene Mollusca from Fetter Lane, E.C. 4, in Reports on temporary Geological Sections. *London Naturalist*, no. 30, 19–20.
Holocene Mollusca from Waterloo, *ibid.*, 30–2.
Holocene Mollusca from Keston, Kent, *ibid.*, 36–7.
(with G. F. ELLIOTT). The London Clay of coastal Suffolk and Essex. *Geol. Mag.* **88**, 329–338 (account of Pleistocene Mollusca from North Shoebury, p. 337).
1953. On the occurrence of Pleistocene Molluscs at Stutton Ness, Suffolk. *Proc. Geol. Assoc.* **64**, 29–30.
1955. Report on the Mollusca, in JESSUP, R. F., and others, Excavation of a Roman barrow at Holborough, Snodland. *Archaeologia Cantiana*, **68**, 60.
The Mollusca of the Bobbits-hole inter-glacial beds, Ipswich. *Trans. Suffolk Nat. Soc.* **9**, 111–114.
1956. Contributions on the non-marine Mollusca, in CARRECK, J. N., The Quaternary deposits of Bowleaze Cove, near Weymouth, Dorset. *Proc. Geol. Assoc.* **66**, (for 1955), 74–100.
(with J. N. CARRECK). Appendix II. Report on the Animal Remains from the Roman Site at Warbank, in Fox, N. P., Keston: a Romano-British Site. *Archaeologia Cantiana*, **69**, 114–5.
1957. (with J. N. CARRECK). Supplementary Notes on the Quaternary deposits of Bowleaze Cove, near Weymouth, Dorset. *Proc. Geol. Assoc.* **68** (in the press).

M. P. KERNEY.

G. L. WILKINS, 1905–1957

GUY LAWRENCE WILKINS was born at Stoke Newington, 5 November 1905, and died on 7 March 1957. In 1921–22 he trained for commercial art at Leyton Technical Institute and worked for four of the leading commercial studios in London until 1949. He served in the army from

February 1951 to November 1945. From his school days he was a keen conchologist, and was a member of the Conchological Society (1925) and Malacological Society (1928). He held various offices on the council of both societies, and for several years was Hon. Secretary of the London branch of the Conchological Society. He was elected President of the Conchological Society in 1949. He acquired an extensive knowledge of Mollusca, particularly of rare species, and built up a fine collection of conchological books.

Wilkins joined the staff of the British Museum (Natural History) in November 1949 as an Experimental Officer, and was put to work on the shell collection, then housed at the north end of the old shell gallery. He was also encouraged to begin work on the older collections, of which the history was in doubt. How well he succeeded in this task, which was greatly to his liking, can be judged from the valuable reports he wrote for the Museum Bulletin on the Sloane, Banks and Cracherode collections (the last of which he left in page-proof). He also published numerous other papers, mainly in *Countryside*, the *Journal of Conchology* and the *Proceedings of the Malacological Society*. Wilkins also employed his artistic skill to help his friends to illustrate their papers, and an excellent example of his work can be seen in the 1950 edition of *Chambers's Encyclopædia* (vol. 9, facing page 476). Other examples of his work are exhibited in the Invertebrate Gallery of the British Museum (Natural History). His last drawing was a masterly water-colour of *Pecten maximus* showing the animal with one valve of the shell removed. Wilkins also made exquisite models in wax of Mollusca, a fine series of which are exhibited at the Royal Scottish Museum.

Wilkins was neat and methodical in his ways, a characteristic which was reflected in his care of the collections. He was always sympathetic to the beginner or amateur who sought information at the Museum, and had a large number of friends at home and abroad who knew that he would willingly look up a reference, compare specimens or even provide a sketch if required. In spite of a diffidence in expressing opinions on conchological matters, he had a wide knowledge and always gave sound advice. He had a wonderful sense of humour, was gentle in all his ways, and no one could have wished for a better friend or colleague. He is survived by his widow, Mrs. Alice Wilkins, who shared all his interests.

W. J. REES.

PROCEEDINGS OF THE CONCHOLOGY SOCIETY OF GREAT BRITAIN AND IRELAND

748th Meeting, held at the British Museum (Natural History), 12 May 1956

The President in the chair.

Communications

" Note on *Hygromia cinctella* (Draparnaud)," by the Rev. H. E. J. Biggs.

" The Molluscan Fauna of some early Post-glacial deposits in North Lincolnshire and Kent," by J. P. T. Burchell and A. G. Davis.

Exhibits

Special exhibits : *Physa* and Veneridae.

The President : Sets of *Lymnaea auricularia* and *L. peregra.*

Rev. H. E. J. Biggs : *Physa* from Egypt and California.

Mr. A. G. Davis : Shells from flood rejectamenta at Ashley Farm, Blashford, near Ringwood, Hampshire (about 60 species, including *Pisidium hibernicum*, *Anodonta minima* and *Valvata macrostoma*).

Mr. T. Pain : Some African species of *Bulinus* ; *Aplexa gigantea*, Eocene, near Rheims ; *Orthalicus labeo* and *Newboldius crichtoni*, Peru.

Mr. L. W. Stratton : British and North American Physidae ; British and New Zealand Veneridae.

749th Meeting, held at the British Museum (Natural History), 20 October 1956

Mr. A. E. Salisbury, vice-president, in the chair.

Election of Member

Lewis Lloyd-Evans, M.B., Ch.B., The Old House, Ware, Herts.

Communications

" *Pinna fragilis* Pennant in Orkney," by R. Rendall.

" *Eubranchus tricolor tricolor* Forbes in Orkney," by R. Rendall.

" The radula of ' *Latiaxis* ' *fritschi*, and description of a new Fossarid," by K. H. Barnard.

Exhibits

Special exhibits : Conidae and Planorbidae : examples were shown by Messrs. Castell, Pitchford and Stratton.

Mr. S. P. Dance : Abnormally large *Planorbis vorticulus* from Pevensey, the biggest being 7·4 mm. in width ; *Pisidium obtusale lapponicum*, with typical *P. obtusale* for comparison.

Mr. A. E. Ellis : *Margaritifera margaritifera* from Isle of Harris, collected by Miss Anne Jamieson (erroneously recorded as *Anodonta cygnea* in *Proc. Linn. Soc.* **167**, 105).

Lt. Col. R. J. Griffiths : *Hygromia liberta*, Hunsdon, Herts ; *Cypraea artuffeli*, Sagami Bay, Japan ; *C. coxeni*, New Georgia, Solomon Islands ; *C. kieneri depriesteri*, paratype ; also several books on Mollusca.

Mr. T. Pain : *Marisa* spp. from South America.

Dr. H. E. Quick : *Milax rusticus* (Millet), Eijsden, Holland, collected by Dr. van Regteren Altena ; young *Rumina decollata* from Majorca, bred in captivity.

750th Meeting, held at the British Museum (Natural History), 17 November 1956

The President in the chair.

Election of Member

Major James Percy Tufnell Burchell, M.C., F.L.S., Falcon Cottage, Fawke Common, Sevenoaks, Kent.

Communications

" *Vertigo moulinsiana* (Dupuy) in Dorset," by A. G. Davis and Mrs. M. M. Davis.

" Notes on *Vertigo moulinsiana* in Hampshire and the Isle of Wight," by A. G. Davis.

" A further note on *Lymnaea stagnalis* (L.) in Anglesey," by Mrs. N. F. McMillan.

" *Nucella lapillus* (L.) with double operculum," by the Rev. H. E. J. Biggs.

" A new species of *Siphonaria* from the Persian Gulf," by the Rev. H. E. J. Biggs.

Exhibits

Special exhibits : Size variation within a species. Examples were shown by Mr. T. E. Crowley, Dr. H. E. Quick and Mr. L. W. Stratton. Mr. and Mrs. Davis and the Rev. H. E. J. Biggs exhibited specimens to illustrate their communications. The President, Mrs. N. F. McMillan, exhibited various British non-marine shells, including *Monacha cantiana* collected at Crail, Fifeshire, 18 August 1956. Lt. Col. R. J. Griffiths showed a specimen of *Cypraea ostergaardi* Dall, collected on Midway Island by V. D. P. Spicer (see *Nautilus*, 1941, **55**, 1–2).

751st Meeting, held at the British Museum (Natural History), 15 December 1956

Mr. A. E. Ellis, vice-president, in the chair.

Election of Member

John L. Staadt-Staid, 123 rue Clovis, Rheims, Marne, France.

Communications

" A Molluscan fauna from alluvium of the New River at Canonbury, North London," by M. P. Kerney.

" Age determination in *Anodonta*," by T. E. Crowley.

" *Vertigo substriata* (Jeffreys) in Hertfordshire," by L. Lloyd-Evans.

" *Edouardia herbigrada* (Pilsbry) in Uganda," by B. Verdcourt.

Exhibits

Special exhibits : *Helicodonta*, Trigoniidae. Examples of one or other of these groups were exhibited by the Rev. H. E. J. Biggs, Mr. C. P. Castell (from the British Museum collections) and Mr. D. Curry.

Lt. Col. R. J. Griffiths : Non-marine Mollusca from Holland, France and Spain.

Mr. M. P. Kerney : *Helicodonta obvoluta* (fragments), Middle Pleistocene, Swanscombe, Kent.

Dr. H. E. Quick : Eggs, laid 26 November 1956, by *Achatina fulica* collected in 1954 when about 1 inch long in Malaya by Lt. Col. R. J. Griffiths.

Mr. Crowley and Dr. Lloyd-Evans exhibited specimens to illustrate their communications.

752nd Meeting, held at the British Museum (Natural History), 19 January 1957

Dr. H. E. Quick, vice-president, in the chair.

Election of Members

Frederick Head Cozens, 57 Greencourt Road, Pett's Wood, Kent.

The Library, H.M. Geological Survey and Museum, Exhibition Road, London, S.W. 7.

Communications

" Notes on the *Pisidium* fauna of the Pevensey Levels district, with special reference to *P. pseudosphaerium* Favre," by S. P. Dance.

" The Holocene molluscan fauna of Southwell and Wheatley, Nottinghamshire," by A. G. Davis and G. W. Pitchford.

Exhibits

Special exhibits : Clausiliidae and Pholadidae. Examples of these families were shown by the Rev. H. E. J. Biggs, Mr. C. P. Castell, Mr. S. P. Dance and Mr. G. W. Pitchford.

Mr. A. G. Davis : *Dreissena polymorpha* (living) from Loxwood Reservoir, Walthamstow, Essex.

Mr. M. Goodchild (visitor) : *Anodonta minima* from R. Arun, Pulborough, West Sussex.

753rd (Annual) Meeting, held at the British Museum (Natural History), 16 February 1957

The President in the chair.

Election of Members

Robert Julius Drake, B.A., Department of Zoology, University of Arizona, Tucson, Arizona, U.S.A.

Robert Pickford Scase, Royal Horticultural Society's Gardens, Wisley, Ripley, Woking, Surrey.

Election of Scrutineers

Mrs. M. Ainsley and Mr. G. W. Pitchford were elected Scrutineers.

Election of Auditors

Miss M. Maitland Howard and Mr. G. L. Wilkins were re-elected Auditors.

Statement of Accounts

The Hon. Treasurer presented the audited accounts for 1956, which were adopted.

Annual Reports

The reports of the Council, the Yorkshire Branch and the Recorder of non-marine Mollusca were presented and adopted.

Votes of Thanks

Votes of thanks were approved to the Trustees of the British Museum (Natural History) for permitting the Society to hold meetings in the Museum, and to the Officers and Council for their work on behalf of the Society.

Presidential Address

The President delivered an address on " The Mollusca of some Cheshire marl-pits : a study in colonization."

Election of Officers and Council

President, Mrs. N. F. McMillan ; Hon. Secretary, C. P. Castell ; Hon. Treasurer, A. E. Salisbury ; Hon. Editor, A. E. Ellis ; Hon. Curator, A. G. Davis ; Hon. Recorders, A. E. Ellis (non-marine) and Mrs. N. F. McMillan (marine). Council : J. F. M. de Bartolomé, H. F. Jones, Lt. Col. R. J. Griffiths, Rev. H. E. J. Biggs, T. E. Crowley, C. A. Raffray.

Exhibits

The President : " The Young Naturalist," an early 19th Century children's card game, including pictures of shells.

Mr. J. F. M. de Bartolomé : Species and varieties of *Murella*, mostly from type localities.

Mr. H. H. Bloomer : *Aequipecten opercularis* showing colour variation.

Mr. T. E. Crowley : George Shaw's *Naturalists' Miscellany* (c. 1805).

Lt. Col. R. J. Griffiths : Some rare cowries.

Mr. G. W. Pitchford : Marine shells from the coast of Cumberland and the Isle of Walney, Lancashire.

Mr. C. A. Raffray : G. Perry's *Conchology* (1811) and E. A. Crouch's *Illustrated Introduction to Lamarck's Conchology* (1826).

Mr. A. E. Salisbury : Some unusual varieties of *Cypraea*.

Mr. L. W. Stratton : Species of *Busycon* and *Fasciolaria* ; shells of *Helix pomatia* with persistent remains of epiphragm (see Ellis, *British Snails*, p. 233).

Report of the Council

Membership has increased by one during the year, to a total of 189, of whom nine are Honorary Members. The Society has lost one member by death, Mr. C. P. Hurst.

Seven ordinary meetings and an Annual General Meeting have been held at the British Museum (Natural History), by kind permission of the Trustees. Two field meetings, at Chertsey and Pevensey, were also held.

The Society is indebted to Dr. K. H. Barnard for a donation of £5.

Two numbers of *The Journal of Conchology* were issued, namely volume 24, No. 3, 20 February, and No. 4, 30 July 1956.

Report of the Yorkshire Branch

The January meeting was held at the Cartwright Museum, Bradford, where the reserve collections, including that of the late F. Rhodes, were examined. The February meeting, held at the Leeds City Museum, was addressed by Mr. J. Armitage on " Some exotic land shells from the Museum collections ". Members read papers on " The larger British Helices " at the March, meeting and at the April meeting there was an exhibition of conchological literature. Mr. S. G. Appleyard was re-elected President at the Annual Meeting and gave his address in November on the subject of " Slugs ", illustrated by pictures, books and specimens, both living and preserved. Field meetings were held at Malham, Newmiller Dam and Wentbridge. The honorary degree of Master of Arts was conferred by the University of Leeds on Mr. J. Digby Firth, in recognition of his contributions to natural history and many other studies.

E. Dearing.

Recorder's Report : non-marine Mollusca

Since the last report (vol. 24, p. 151) the following records have been authenticated. Several of these have again been supplied by Mrs. N. F. McMillan from the collections in the City of Liverpool Public Museums (LPM).

Devon South (3) : *Carychium tridentatum*, Stoke Woods, Exeter, A.E.E.

Dorset (9) : *Agriolimax caruanae*, Sherborne, A.E.E.

Hants South (11) : *Anodonta minima*, *Pisidium hibernicum*, R. Avon, Blashford, A. G. Davis.

Herts (20) : *Hygromia liberta*, Hunsdon, R. J. Griffiths ; *Vertigo substriata*, L. Lloyd-Evans.

Berks (22) : *Milax budapestensis*, Reading, H. E. Quick ; Maidenhead, S. P. Dance.

Oxford (23) : *Valvata macrostoma*, Port Meadow, Oxford, A. J. Cain and D. Nichols.

Bucks (24) : *Pisidium personatum*, Burnham Beeches, S. P. Dance.

Derby (57) : *Anodonta anatina*, Shardlow (canal), G. W. Pitchford.

Chester (58) : *Milax gagates*, *M. sowerbyi*, Hilbre Island, Mrs. N. F. McMillan.

Lancaster South (59) : *Cochlicopa lubricella*, Southport (Holocene), J. W. Jackson (LPM).

York South-west (63) : *Pisidium pulchellum*, C. Ashford (LPM).

Westmorland (69): *Planorbarius corneus*, Urswick Tarn, Furness, G. W. Pitchford; *Pisidium henslowanum*, Ambleside, A. M. Norman (LPM).

Fife (85): *Planorbis vortex*, St. Andrews, Mrs. N. F. McMillan.

Aberdeen North (93): *Arion rufus*, King Edward; *Potamopyrgus jenkinsi*, *Helicella caperata*, Cruden Bay, Mrs. N. F. McMillan.

Orkney (111): *Columella edentula*, A. W. Stelfox (LPM).

Tyrone (118): *Sphaerium lacustre*, Baron's Court, R. Welch (LPM).

Donegal West (119W): *Cochlicopa lubricella*, Tranarossan and Rosapenna (Holocene), J. W. Jackson (LPM); *Vallonia excentrica*, Inishmeane, A. W. Stelfox (LPM).

Wexford (127): *Cochlicopa lubricella*, Blackwater Cliffs (Holocene), Mrs. N. F. McMillan.

Longford (133): *Theodoxus fluviatilis*, Ballymahon, A. W. Stelfox (LPM).

Galway West (139): *Vallonia excentrica*, Inishmacdara, A. W. Stelfox (LPM).

Clare (141): *Succinea oblonga*, Aran Isles, A. W. Stelfox (LPM).

Mr. A. G. Davis has sent records of *Carychium minimum s.s.* from Hants South (11), Sussex West (13), Bucks (24), Norfolk West (28) and Gloucester East (33).

A. E. E.

754th Meeting, held at the British Museum (Natural History), 16 March 1957

Mr. A. E. Ellis, vice-president, in the chair.

Members Deceased

The Chairman reported the deaths of Arthur George Davis (on 1 March) and Guy Lawrence Wilkins (on 7 March), both past Presidents of the Society.

Member Elected

Robert William Greenish, White Ridge, Ruxley Heights, Claygate, Surrey.

Communications

" *Glypteuthria capensis*: a generic correction," by K. H. Barnard.

" Types of *Cypraea lynx* var. *williamsi* Melvill," and " Notes on Dixon and Watson's *Descriptive Manual of British Land and Freshwater Shells* ", by Mrs. N. F. McMillan.

" *Lauria sempronii* (Charpentier) in the English Holocene," by M. P. Kerney.

Exhibits

Special exhibits: camouflage and mimicry.

Mr. C. P. Castell: *Lessons on Shells as given to children between the ages of eight and ten in a Pestalozzian School at Cheam, Surrey*, by the author of *Lessons and Objects*, 2nd edition, London, 1838.

Mr. T. E. Crowley: *Xenophora pallidula.*

Mr. S. P. Dance : living *Acanthinula lamellata* from Burnham Beeches, Bucks.

Lt. Col. R. J. Griffiths : Colour photograph of living *Cypraea moneta*, taken under water, from Miss Alison Kay, Hawaii ; *Cypraea nigropunctata* from the Galapagos Islands.

Mr. L. W. Stratton : *Liarea* from New Zealand.

755th Meeting, held at the British Museum (Natural History), 13 April 1957

The Rev. H. E. J. Biggs in the chair.

Communications

" *Pisidium conventus* Clessin in Loch Rannoch " and " Large *Planorbis vorticulus* Troschel near Pevensey ", by S. P. Dance.

" Lieut. Hankey and *Cypraea* growth," by R. J. Griffiths.

" The Molluscan sequence in the Lea Valley," by J. F. Hayward.

" *Pomatias elegans* (Müller) living in east Hertfordshire," by M. P. Kerney.

Exhibits

Special exhibits : Cyclophoridae, Solenidae.

Mr. G. A. S. Barnacle : Shells collected on a visit to South Africa and Rhodesia.

The Rev. H. E. J. Biggs : *Cyclophorus*.

Mr. C. P. Castell and Mr. S. P. Dance : Fossil and Recent Cyclophoridae and Solenidae from the British Museum collections.

756th Meeting, held at the British Museum (Natural History), 18 May 1957

Mr. A. E. Ellis, vice-president, in the chair.

Members Elected

Sven Laufeld, N. Stenbocksgat 44, Hälsingborg, Sweden.
E. Robson, M.P.S., Ph.C., Box 30077, Nairobi, Kenya.

Communications

" Note on *Acme fusca* (Montagu) in West Kent," by H. E. J. Biggs and F. H. Cozens.

" A large example of *Potamopyrgus jenkinsi* (Smith)," by H. E. J. Biggs.

" *Vitrina major* (Férussac) in Surrey," by H. E. Quick.

" The radula of *Cancellaria*," by K. H. Barnard.

Exhibits

Special exhibits : British Unionidae, Harpidae. Examples were shown by Mr. R. P. Scase and Mr. C. P. Castell (from the British Museum collections). Species of *Vitrina* were exhibited by Mr. Castell and Mr. A. E. Ellis, and Dr. Quick demonstrated his dissection of *Vitrina major* collected by Mr. P. Coxhead in Surrey. Mr. Scase exhibited abnormal *Discus rotundatus* from White Downs, Surrey, and Mr. L. W. Stratton land shells from localities in Hertfordshire, including *Ena montana* and *Clausilia rolphii*.

ACCOUNTS FOR THE YEAR ENDING 31 DECEMBER 1956.

Income and Expenditure Account.

Dr.

	£	s.	d.	£	s.	d.
To Annual Subscriptions—						
,, Paid in 1955 . . .	2	0	0			
,, Paid for 1956 . . .	96	1	0			
,, Arrears	9	0	4	107	1	4
,, Sales				235	18	8
,, Donation				5	0	0
,, Transfer from Life Membership Fund				20	10	0
,, Dividends				28	0	0
				£396	10	0

Cr.

	£	s.	d.	£	s.	d.
By Publication and Distribution—						
,, Vol. 24, part 3 . . .	140	2	6			
,, Author's reprints . . .	14	2	6	154	5	0
,, Vol. 24, part 4 . . .	166	14	11			
,, Author's reprints . . .	11	17	9	178	12	8
,, Dispatch of Parts . . .				1	6	2
,, Printing and Stationery . .				8	5	0
,, Zoological Record . . .				2	0	0
,, Cheque Book					4	0
,, Officers' Expenses . . .				8	12	4
,, Balance being excess of Income over Expenditure . . .				43	4	10
				£396	10	0

Life Membership Fund.

	£	s.	d.
To Amount of Fund, 1 January 1956 . .	549	14	0
,, Composition Fee	20	0	0
,, Dividends and Interest	20	10	0
	£590	4	0

	£	s.	d.
By Transfer to Income and Expenditure Account	20	10	0
,, Amount of Fund, 31 December 1956 . .	569	14	0
	£590	4	0

Research and Reserve Fund.

	£	s.	d.		£	s.	d.
To Amount of Fund, 1 January 1956 . .	405	4	11	By Amount of Fund, 31 December 1956 . .	420	0	5
,, Dividends and Interest	14	15	6				
	£420	0	5		£420	0	5

BALANCE SHEET.

Liabilities				£	s.	d.	Assets	£	s.	d.	£	s.	d.
Annual Subscriptions in advance . . .				16	8	0	4% Funding Loan (cost) . .	350	0	0			
Life Membership Fund				569	14	0	2½% Defence Bonds (cost) . .	200	0	0			
Research and Reserve Fund				420	0	5	3½% War Loan (cost) . . .	40	0	0			
Capital Stock				800	0	0	3½% Defence Bonds (cost) . .	800	0	0	1,390	0	0
Balance from Income and Expenditure Account—													
As on 1 January 1956 . .	£357	1	7				Cash at Bankers—						
For 1956	43	4	10				National Provincial Bank .	281	15	2			
				400	6	5	Post Office Savings Bank .	529	13	8			
							Cash in hand . . .	5	0	0	816	8	10
				£2,208	8	10					£2,206	8	10

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CONTENTS.

PAGE

The Holocene Molluscan Fauna of Southwell and Wheatley, Nottinghamshire—A. G. DAVIS and G. W. PITCHFORD 227

Note on *Acme fusca* (Montagu) in West Kent—H. E. J. BIGGS and F. H. COZENS . 233

On an unfigured species of *Plekocheilus* (*Eurytus*) from Colombia—T. E. CROWLEY and T. PAIN 234

Vitrina major (Férussac) in Surrey, with some remarks on the species—H. E. QUICK 235

A large example of *Potamopyrgus jenkinsi* (Smith)—H. E. J. BIGGS . . . 238

The Molluscan Sequence in the Lea Valley—J. F. HAYWARD 239

The radula of *Cancellaria*—K. H. BARNARD 243

Monacha cantiana (Montagu) in Pembrokeshire—M. P. KERNEY 244

Pisidium conventus Clessin in Loch Lomond—W. RUSSELL HUNTER and H. D. SLACK 245

Pisidium from Hirta, St. Kilda—W. RUSSELL HUNTER and J. D. HAMILTON . . 247

Dixon and Watson's *Descriptive Manual of British Land and Freshwater Shells*—J. W. JACKSON 248

A new species of *Siphonaria* from the Persian Gulf—H. E. J. BIGGS . . . 249

On the occurrence of *Margaritifera auricularia* (Spengler) in the English Pleistocene M. P. KERNEY 250

Note on *Petricola pholadiformis* Lamarck—E. ST. JOHN BURTON . . . 251

Acanthinula lamellata (Jeffreys) in Pembrokeshire—L. LLOYD-EVANS . . . 252

Extension du Gastropode méditerraneen, *Cochlicella acuta* (Müller), dans le sud-est de l'Angleterre—M. DE LEERSNYDER et H. HOESTLANDT 253

Lieutenant Hankey and *Cypraea* growth—R. J. GRIFFITHS 265

Reviews 266

Proceedings: 19 October 1957 267

PLATE 7

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THE HOLOCENE MOLLUSCAN FAUNA OF SOUTHWELL AND WHEATLEY, NOTTINGHAMSHIRE

By A. G. DAVIS and G. W. PITCHFORD

(*Read before the Society*, 19 *January* 1957)

OUR knowledge of the peat and associated deposits belonging to the drainage systems of Nottinghamshire is largely due to Musson (1) and Lamplugh (2). Half a century has passed since their researches were published and as these authors do not refer to the localities about to be described, the present account is not untimely.

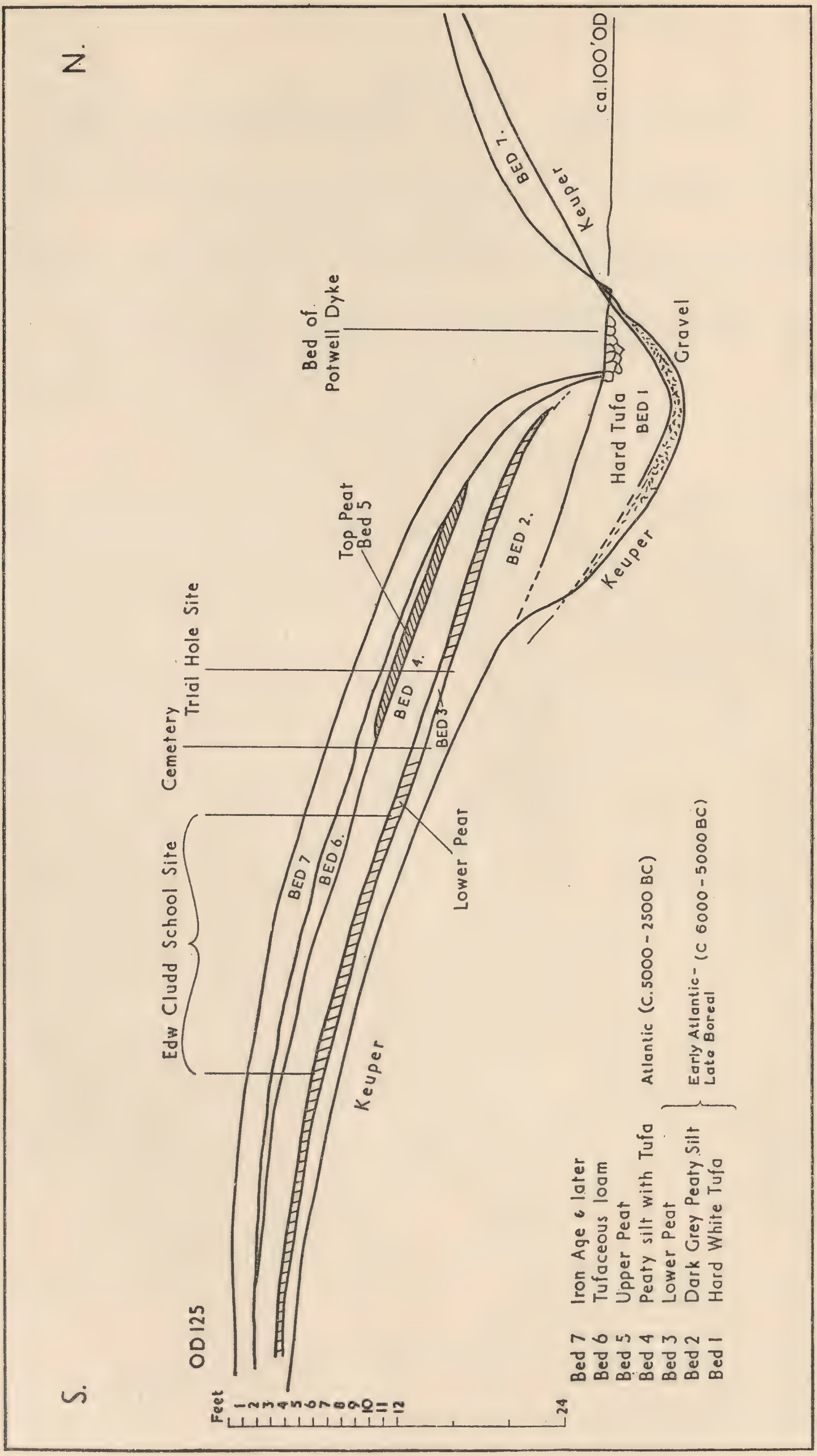
One of us (G.W.P.) has since 1949 accumulated notes and material based upon the examination of temporary exposures afforded by drainage and building operations at Southwell. Besides obtaining information from mole heaps and rabbit warrens, he has put down trial holes in an attempt to establish the local succession of these interesting Holocene deposits.

The area studied at Southwell forms a part of the south bank of the drainage channel known as Potwell Dyke, which at its source is named Westhorpe Dumble, a tributary of the River Greet belonging to the Trent river system. The stream runs north-easterly, a little southward of Southwell Minster where it has eroded for itself a deep gully, the bottom of which shows a pavement of hard white tufa. This bed of tufa can be seen for a distance of about 20 yards, lying a little below O.D.100, and is the only permanent exposure in the district.

The Southwell deposits occur in a semi-circular area 1½ miles in length whose centre is about ¼ mile south of the Minster (Nat. Grid 43/702534). The deposits do not appear to rise above the 125 ft. contour, they are very variable within short distances and there is some interdigitation of tufa with peat. At no exposure has it been possible to view the complete sequence and a succession of more than two types of lithology has been visible only on rare occasions.

From the information available, the sequence is as follows :—

(7) Soil, changing to a marsh clay type at base	1 ft. 6 in.–2 ft. 0 in
(6) Tufaceous loam	3 ,, 0 ,,
(5) Peat (Top or Upper Peat)	0 ,, 6 ,,
(4) Peaty silt with interdigitations of hard tufa	2 ,, 0 ,,
(3) Peat with thin lamina of powdery tufa (Lower peat)	0 ,, 9 ,,
(2) Dark grey peaty silt	2 ft. 0 in.–4 ,, 0 ,,
(1) Hard white tufa	2 ,, 0 ,,–4 ,, 0 ,,


S.
N.
OD 125
ca.100'OD
Feet
1 2 3 4 5 6 7 8 9 10 11 12
24
Edw Cludd School Site
Cemetery
Trial Hole Site
Top Peat
Bed 5
Bed of
Potwell Dyke
BED 7
BED 6.
BED 4.
BED 3
BED 2.
BED 1
Hard Tufa
Gravel
Keuper
Keuper
Keuper
Lower Peat
BED 7.
Bed 7 Iron Age & later
Bed 6 Tufaceous loam
Bed 5 Upper Peat
Bed 4 Peaty silt with Tufa
Bed 3 Lower Peat
Bed 2 Dark Grey Peaty Silt
Bed 1 Hard White Tufa
Atlantic (C.5000 - 2500 BC)
Early Atlantic - Late Boreal (C 6000 - 5000 BC)

PARTICULARS OF BEDS 1 TO 7

(Initials denote authority for the following observations.
NM = Mrs. N. F. McMillan)

Bed 7. Dead Mollusca occur in the soil and are of forms still living on the site—see first column of tabular faunal list. G.W.P.

Bed 6. The tufa is granular or powdery and occurs on both sides of Potwell Dyke. 40 species. *Helix aspersa* makes its first appearance here. Iron Age. N.M., G.W.P., A.G.D.

Bed 5. Seen only east of Southwell Cemetery. 8 species. N.M., G.W.P.

Bed 4. Foundations of Edward Cludd Secondary School (Nat. Grid 43/669533), Southwell Cemetery (Nat. Grid 43/702534) and Trial Holes in adjacent fields made by G.W.P. (Nat. Grid 43/701533) ; seems to extend over the whole area to Newark Road. The tufa was stained pink at the school foundations probably by the overlying peat. 21 species. G.W.P.

Bed 3. The tufaceous laminae are very thin and broken surfaces of the peat give the appearance of having been dusted with a white powder. Good exposures during building of Edward Clud Secondary School, 1955–56. Nat. Grid 43/699533. 52 species. A sample weighing 2 lb., when dried, yielded 1,116 shells representing 33 species. G.W.P., A.G.D.

Bed 2. Extends from Nottingham Road to the vicinity of Easthorpe. Exposed during drainage of marsh for Southwell Cemetery, 11 feet from the surface (Nat. Grid 43/702534) ; no shells collected. G.W.P.

Bed 1. A hard massive type of tufa. Shells are rare and belong to land forms : *A. arbustorum*, *H. hispida*, *V. pulchella*, *C. lubrica*. Some gravel occurs between the tufa and north bank of Potwell Dyke (Nat. Grid 43/707541), but it has not been determined whether it is modern or extends under the tufa, or indeed if it is *in situ*. The country rock is of Keuper (Trias) age (? Keuper Marl). G.W.P.

The faunas encountered in the above sequence are enumerated in detail in the appended faunal list. For comparison with the fossil faunas a list is given of 20 species found by G.W.P. on the sites before they were excavated. For comparison with beds 3 and 4, an unpublished list of fossil Mollusca from Wheatley, Notts, is given. This list occurs in the A. S. Kennard MSS. and is based upon material collected by B. Sturges Dodd and J. W. Carr *c.* 1900–15. The only information obtained about these shells is that they were collected from a layer above the peat in the valley between North Wheatley and South Wheatley, the latter being 4 miles south-west of Gainsborough and 22 miles north of Southwell. The Wheatley fauna comprises 53 species and in most respects compares closely with Bed 3 of Southwell, the chief difference being that those species absent from Southwell are woodland forms, which can only mean that woodlands did not come within the restricted Potwell drainage area.

The Southwell deposits and their Mollusca show the climatic and other changes that have taken place since the end of the Late Glacial times. Such changes are the result of variations in climate and rainfall and fluctuations in the supply of lime-charged water which deposited tufa at three horizons.

The period of maximum abundance of molluscan life occurs in Bed 3, which contains a fauna comparable with those of Copford and Takeley (Essex), Broughton (Lincs), Wateringbury (Kent) and Blashenwell (Dorset), which are generally accepted as belonging to the Atlantic phase of the Holocene with a maximum rainfall and a high annual temperature (*c.* 5000–2500 B.C. Late Mesolithic).

The fauna of Bed 1 is a restricted one of four species which are useless as indicators of age or climate, but they all occur in known Boreal assemblages (*c.* 6800–5000 B.C.).

Both in numbers and in species, beds 4 to 7 show a marked deterioration in the fauna since the close of the Atlantic and they may be interpreted as representing the sequence from the Atlantic to the present time. The appearance of *Helix aspersa* in the upper limit of Bed 6 indicates the Sub-Atlantic phase (Early Iron Age).

Since Atlantic times *Discus ruderatus* and *Vertigo parcedentata* have become extinct in Britain; the following, though formerly abundant, have become locally extinct: *Vertigo alpestris*, *V. pusilla*, *V. substriata*, *V. moulinsiana*, *V. angustior* and *Catinella arenaria*.

FAUNAL LIST

	Recent	Bed 6	Bed 5	Bed 4	Bed 3	Wheatley
Valvata cristata Müller					59	Ab
V. piscinalis (Müller)					3	10
Acme lineata (Drap.)						60
Bithynia tentaculata (Linné)		21	26		372	Ab
B. leachii (Sheppard)				1		
Carychium minimum Müller	C	22			1,430	
C. tridentatum (Risso)		2		24	26	Ab
Lymnaea stagnalis (Linné)						2
L. truncatula (Müller)	C	3		5	86	C
L. peregra (Müller)		15			175	C
L. auricularia (Linné)		1				
L. palustris (Müller)		31	30	24	439	C
Aplexa hypnorum (Linné)		3			127	C
Physa fontinalis (Linné)						1
Planorbis planorbis (Linné)		1				3
P. crista (Linné)		51		8	402	C
P. leucostoma Millet		36		6	710	Ab
P. vortex (Linné)					15	
Catinella arenaria (Bouch.-Chant.)					6	
Succinea pfeifferi Rossm.	C	26	3	5	129	Ab

Ab = abundant. C = common. R = rare. X = number unspecified.

	Recent	Bed 6	Bed 5	Bed 4	Bed 3	Wheatley
S. putris (Linné)	C			2	3	
Cochlicopa lubrica (Müller)	C	35	2	28	268	Ab
Columella edentula (Drap.)					5	45
Vertigo pusilla Müller						40
Vertigo antivertigo (Drap.)		91	31	41	2,001	Ab
V. substriata (Jeffreys)					27	12
V. pygmaea (Drap.)		1			28	10
V. parcedentata (A. Braun.)					23	
V. moulinsiana (Dupuy)					37	200
V. alpestris Alder						1
V. angustior Jeffreys		4		1	82	150
Pupilla muscorum (Linné)		8			8	18
Acanthinula aculeata (Müller)						30
A. lamellata (Jeffreys)						130
Vallonia pulchella (Müller)		36		40	545	Ab
V. excentrica Sterki		21		7	38	Ab
V. costata (Müller)		18			59	Ab
Clausilia bidentata (Ström)	X				3	80
Marpessa laminata (Montagu)						6
Balea perversa (Linné)					2	
Ceciloides acicula (Müller)	C	2		4	5	110
Helicigona lapicida (Linné)						5
Arianta arbustorum (Linné)	C	4			21	
Helix nemoralis Linné	C	20			15	C
H. aspersa Müller		3				
Hygromia striolata (C. Pfeiffer)	X					
H. hispida (Linné)		28		12	161	
H. liberta (Westerlund)		19				Ab
Monacha granulata (Alder)		1			1	
Punctum pygmaeum (Drap.)		17		2	132	Ab
Discus ruderatus (Hartmann)					3	6
D. rotundatus (Müller)	C	5	1	1	25	Ab
Arion intermedius Normand	C					
A. subfuscus (Drap.)	X					
Arion sp.		28		20	26	1
Euconulus fulvus (Müller)	C	25	7		310	Ab
Vitrea crystallina (Müller)	X	1		1	6	C
Oxychilus cellarius (Müller)	C				4	Ab
O. alliarius (Miller)						3
Retinella nitidula (Drap.)		4			7	C
R. pura (Alder)	C					
R. radiatula (Alder)	R	22			70	Ab
Zonitoides nitidus (Müller)		6		2	468	Ab
Vitrina pellucida (Müller)		29			1	2
Agriolimax reticulatus (Müller)	C					
Limax sp.		2	3	2	19	1
Anodonta anatina (Linné)		fgts.			fgts.	
Unio sp.		fgts.			fgts.	
Pisidium casertanum (Poli)		2			X	2
P. personatum Malm	C				X	Ab
P. obtusale C. Pfeiffer					X	18
P. milium Held					X	3
Total number of species	20	40	8	21	52	53

Vertigo antivertigo (Draparnaud).

This is one of the most abundant species in the Southwell beds, but it is uncertain if it has ever been found living in the county. It has been recorded from a number of localities, but an examination of most of the specimens shows that they have been derived from surface outcrops of beds of peaty tufa.

In Bed 3 a sinistral monstrosity was found, being the first to be recorded of this species living or fossil. Ancey (3) and Dautzenberg (4) give exhaustive lists of dextral and sinistral monstrosities, but this species is absent from these lists. The only sinistral monstrosity of *Vertigo* recorded from Britain is *V. substriata* from Shipley Glen, Yorks, Standen (5).

A peculiarity of the Southwell specimen, which is fully grown and in good condition, is that it bears only one parietal denticle. The one that should appear nearest the columella has not been formed. The absence of the paired parietal denticles has been noticed on some of the normally coiled specimens, while one elongate example bears three and a vestige of a fourth.

Vertigo moulinsiana (Dupuy).

Not recorded as living in the county. Examination of the specimens shows that the early records for Darlton and Carlton on Trent were based on material derived from Holocene deposits.

Vertigo parcedentata (Braun) (= *genesii* Gredler).

Not previously recorded from the county and extinct in Britain. This is a form which seems to have become extinct with the arrival of Bronze Age conditions. The nearest records are Kirby Fleetham, Yorks (Boreal); Scawby and Broughton, Lincs (Boreal-Atlantic). For discussions on this species see Kerney (6) and Sparks (7).

Vertigo alpestris Alder.

This species now occurs north of a line drawn from South Yorkshire to North Wales, but formerly it had a more southern range, for it is frequently found in Mesolithic deposits in southern England. Very fine examples have been obtained from the tufa of Broughton, Lincs.

Vertigo substriata (Jeffreys) and *V. angustior* Jeffreys.

Not known with any certainty to be living in the county. Recorded finds are probably from Holocene deposits.

Discus ruderatus (Férussac).

Extinct in Britain and apparently died out with the inception of the Bronze Age. It is well known from some of the mild Interglacial deposits of this county.

Catinella arenaria (Bouchard-Chantereaux).

A new record for Nottinghamshire. Six examples were recovered from Bed 3. In Great Britain the living form seems to be restricted to the sandy dunes of Braunton Burrows, North Devon, but has a wider distribution in southern Ireland. The fossil distribution of this shell remains to be determined. There are examples attributed to this species in the A. S. Kennard collection from Boreal deposits at Reculver, Kent, and Middleton-on-Sea, Sussex.

ACKNOWLEDGMENTS

The writers wish to express their thanks to Mrs. N. F. McMillan for help in the early stages of this investigation. To Dr. E. I. White, Keeper of Palaeontology, British Museum (Natural History), for permission to publish extracts from the A. S. Kennard MSS. and to Mr. C. P. Castell for advice and access to the Kennard Collections.

To Dr. H. E. Quick we are indebted for his determination of *Catinella arenaria* and to Mr. S. P. Dance for his identifications of the species of *Pisidium*.

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Records of shells from Wheatley occur in :—
CARR, J. W., 1916, *The Invertebrate fauna of Nottinghamshire*, and
ELLIS, A. E., 1926, *British Snails*.

Note on *Acme fusca* (Montagu) in West Kent.—On 6 April we were working a hollow in the chalk beside the road on Polhill for Mollusca. This locus is near the bottom of the hill on the right-hand side going to Otford. Under a dead tree-stump were found seven living and one dead shell of this species. The weather was dry and warm and cloudy. A second visit to this spot on 26 April yielded only two recently dead shells and one living after very considerable search. These were taken from the crevices in the dead bark on the stump. The sky was overcast and threatening rain, the wind very strong from the north. The coldness which made collecting a little unpleasant may have affected the activity of the snails. There seems to be some doubt as to whether this species lives in Kent West, and this note is offered so that the record can now be made with certainty.

H. E. J. BIGGS and F. H. COZENS.

(*Read before the Society*, 18 *May* 1957)

ON AN UNFIGURED SPECIES OF *PLEKOCHEILUS* (*EURYTUS*) FROM COLOMBIA

By T. E. Crowley and T. Pain

(*Read before the Society,* 19 *October* 1957)

[Plate 7.]

Plekocheilus* (*Eurytus*) *taquinensis (Pfeiffer)

Bulimus taquinensis Pfeiffer, 1854. *Proc. Zool. Soc. Lond.* 290 ; *Monogr.* **4**, 380.

Plekocheilus (*Eurytus*) *taquinensis* Pilsbry, 1895–6. *Manual of Conchology* (2nd Series), **10**, 81.

Original description : " Shell subperforate, ovate-oblong, rather solid, longitudinally minutely striated and malleated ; painted with indistinct oblique reddish streaks under a brownish-olive cuticle. Spire convex-conic, rather obtuse ; whorls 4, moderately convex, the last a little longer than the spire, rounded at the base. Columella lightly folded. Aperture subvertical, acuminate oval, pearly inside ; peristome somewhat thickened, flesh-coloured, right margin revolute, columellar margin subovated, horizontally spread and reflexed.

" Length 40, diameter 18 mill., aperture with peristome 20 mill. long, width inside 11 mill." (Pfeiffer.)

Type locality Taquina, Sierra Nevada di Sta. Marta, Colombia, 9,000 ft. alt. (Mus. Cuming).

The holotype, together with two paratypes of this very distinctive member of the subgenus *Eurytus*, are in the Cuming collection at the British Museum (Natural History), and two additional examples (one immature), were obtained by one of us (T.P.) in the vicinity of the type locality in 1939. The four adult specimens known to us are roughly similar in size (see table of measurements) and appearance. The deep, crenulate suture, bulbous whorls, and somewhat boat-shaped aperture are distinctive.

Pilsbry (1895–96), who did not apparently have access to any specimens, merely copies Pfeiffer's description without comment. This species, so far as we have been able to ascertain, does not appear to have been subsequently referred to in literature, nor has it ever been figured.

The type locality lies some 9,000 ft. up in the Sierra Nevada di Sta. Marta in the Republic of Colombia and is heavily wooded. The two examples obtained in 1939 were both dead shells although in good condition ; the animal is consequently unknown. The shortness of the visit, combined with the dry conditions then prevailing, may in the main account for this, and a more thorough search in the area during the rains might be expected to produce living examples.

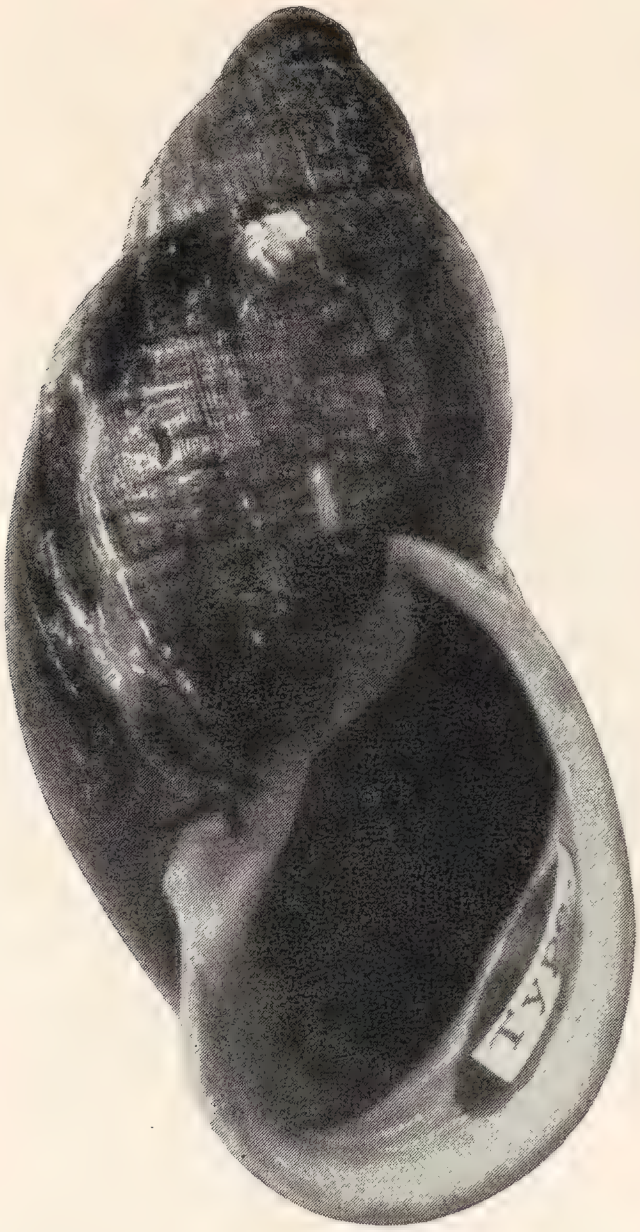
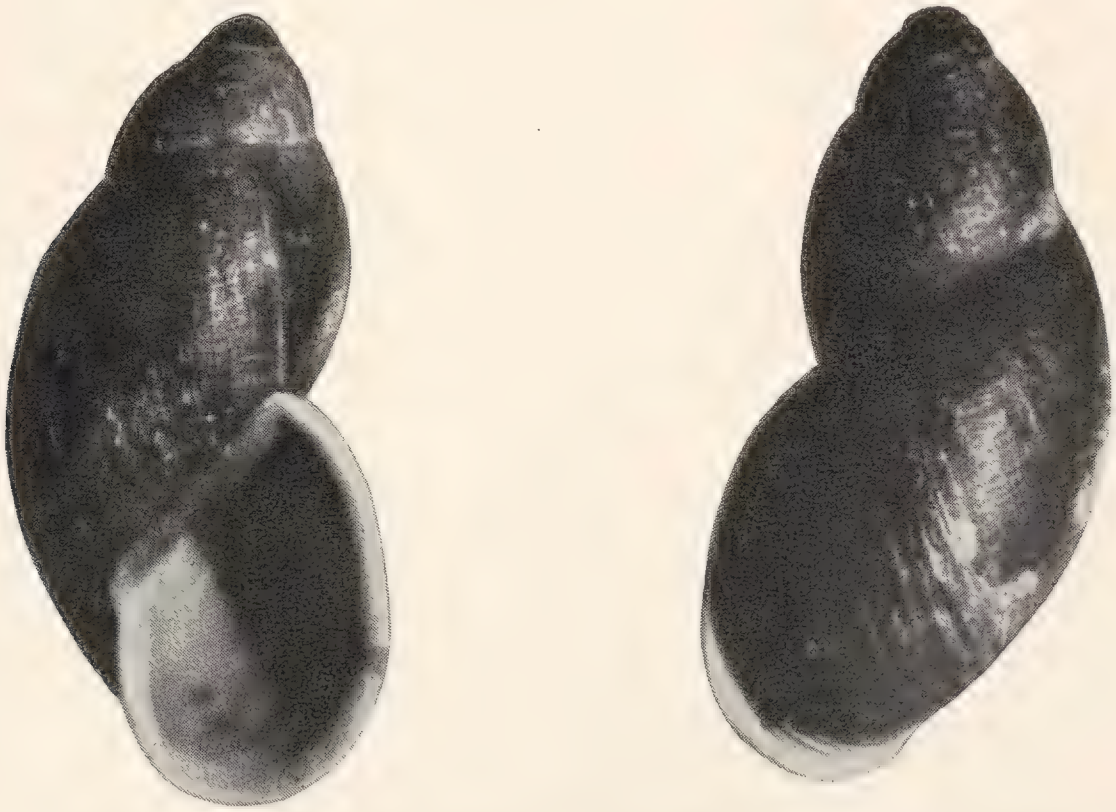


FIG. 1.—Type specimen, British Museum (Natural History) registered No. 1957-6-3-1 (Cuming collection). × 2.



FIGS. 2 and 3.—Topotype, collected by T. Pain, 1939. Natural size.

Plekocheilus (*Eurytus*) *taquinensis* (Pfeiffer)

[*To face p.* 234.

MEASUREMENTS (in millimetres)

	Length.	*Max. diameter.*	*Aperture (external).*	
1.	40	21	23 × 15	Holotype (B.M.N.H.)
2.	37	22	24 × 16	Paratype (B.M.N.H.)
3.	37	21	22 × 15	Paratype (B.M.N.H.)
4.	47	22	25 × 16·5	Topotype (Pain Coll)

The small immature shell taken in 1939 is now in the Museum of Comparative Zoology at Harvard College, U.S.A.

It will be observed that the measurements given above for the type do not agree with those mentioned in the original description. The original aperture dimensions were measured internally and measurement of shell diameter appears to have been that of the body whorl only.

The authors wish to thank the authorities of the British Museum (Natural History) for permission to figure the type and for facilities to examine the specimens.

VITRINA MAJOR (FÉRUSSAC) IN SURREY, WITH SOME REMARKS ON THE SPECIES

By H. E. QUICK

(Read before the Society, 18 *May* 1957)

BOYCOTT (1922, *Proc. Malac. Soc.* **15,** 123) was the first to record the occurrence of *Vitrina major* (Férussac) in the British Isles, from Cusop Dingle, Brecon, where he found a single specimen in rough open scrub, moderately calcareous, with 21 other species. He points out that a well grown shell differs from that of *V. pellucida*, being flatter with the aperture accordingly wider and not so high. The Cusop specimen attracted attention by its dark pigmentation and large mantle, and by being active on 22 April, by which season *V. pellucida* is dead or dying. Boycott gives figures of the genitalia, which differ markedly from those of *V. pellucida*, the long free oviduct bearing a conspicuous globular swelling of cartilaginous consistency, coated externally with glandular tissue and opening into the long vagina by a conical spout with a very narrow lumen.

Bowell (1926, *Proc. Malac. Soc.* **17,** 145, pl. 11) published a description and photographs of the radula. There are more lateral teeth in *V. major* than in *V. pellucida* and *V. hibernica*, and in *V. pellucida* the outer side of the marginals is pectinate, which is not the case at any rate in adult *V. major.* Woodward (1926, *ibid.*, 147) published photographs of the shell, taken by A. E. Salisbury.

Taylor (1927, *J. Conch.* **18**, 105) figures our three species of *Vitrina* from living animals, and there is a figure by Dean of *V. major* in *Proc. Malac. Soc.* **17**, 143. Boycott points out that the mantle and lobes in Dean's figure are at the minimum. In the figures in Taylor's paper the mantle is also shown extending less far forwards than in *V. pellucida*, though it is rightly shown as more thick, black and rugose. I think the shell of *V. major* is shown too large, in comparison with the adjacent figure of *V. pellucida*.

Boycott (1926, *Proc. Malac. Soc.* **17**, 141) summarizes all the records to date, and gives the following results of 16 visits he made to Cusop and to Burnham Beeches, Bucks :—

Cusop		Burnham Beeches	
22 April 1922	1	21 July 1922	1
11 November 1922	0	19 April 1923	0
20 April 1923	7	20 October 1923	0
31 July 1923	0	5 January 1925	1
18 July 1924	0	23 April 1925	0
10 April 1926	5	1 January 1926	0
		27 February 1926	0
		9 April 1926	1 (dead)
		15 April 1926	1 (dead)
		18 December 1926	0

It would appear, therefore, that *V. major* is not only local in Great Britain but also rare where it does occur, for Boycott was a very good collector.

To complete the British records of *V. major*, Boycott (1930, *J. Conch.* **19**, 60) notes that the Rev. E. P. Blackburn found an empty shell of this species near Rothley, Northumberland, 28 March 1930, while 46 *Vitrina*, six of which were living, collected on 26 April 1930, were all *V. pellucida*. In Blackburn's collection there are two shells of *V. major* among a number of *V. pellucida* taken at Birdlip, Gloucestershire, in 1908. Boycott (1928, *J. Conch.* **18**, 274) found two *V. major* alive in Humblebee Wood, Gloucestershire, on highly calcareous ground, 10 April 1928. Twenty-five soft white sticky eggs obtained from these measured 1·35 × 1·07 mm. Moquin-Tandon's measurement of 0·33 mm. is therefore probably a misprint for 1·33 mm. Boycott (1930, *J. Conch.* **19**, 60) collected three living *V. major* and two empty shells in the open woods of Roncombe Goyle between Seaton and Honiton, Devon, on neutral or acid soil, 14 April 1930. He also found *V. major* in Cheddar Wood, Somerset, 5 April 1932 (recorded in *J. Conch.* **19**, 344), and together with Charles Oldham took one young specimen, confirmed by the radula, on a roadside wall above Llanfoist, Monmouthshire, 26 September 1936. Ellis (*J. Conch.* **21**, 190) collected six living *V. major* in Stoke Woods near Exeter, early in May 1939. Quick (*J. Conch.* **22**, 312) found four living *V. major* in moss on the earth bank of a lane near what used to be the Eric Gill Colony, then a guest house, at Capel-y-ffin near Llanthony Abbey in the Black Mountains, Brecon, 6 June 1946. He also collected seven living specimens in moss on an embankment in the Priory grounds, Brecon, separating the woods from the river Usk, 9 May 1948 (*J. Conch.* **23**, 60).

On the Conchological Society's field excursion to Sheep Leas, West

Horsley, Surrey, on 5 May 1957, Mr. P. Coxhead found a living *Vitrina* in the woods (map reference 51/089512), which attracted attention because it was alive at that date, and was very darkly pigmented. Subsequent dissection confirmed that this was undoubtedly *V. major*, a new county record.

Though no very ancient trees now occur on some of the sites where *V. major* is found, they appear to have been long undisturbed and perhaps never cultivated. The soil can be either alkaline, neutral or perhaps acid. The species seems to be scarce where it occurs and where *V. pellucida* may be abundant, though it may have been overlooked by collectors not familiar with the seasonal difference of the two species, *V. pellucida* being a winter breeder while *V. major* reaches maturity in spring.

In 1946 and 1948 I was fortunate enough to witness the mating of *Vitrina major*, and found that it differs from the account given by Gerhardt (1935, *Zeitsch. Morphol. u. Oekol. Thiere* **30**B, 299 ; 1936, **31**B, 435).

One of a pair at 7.30 p.m. followed the partner for one hour, then they circled closely and the penis and another cylindrical organ were rapidly everted. This organ tapered at its extremity. It was in continual movement over the partner's everted organs, reminding one of the sarcobelum of *Agriolimax*. Once one animal took the tip of this organ into its mouth. After sketching, at 9.10 p.m. they were fixed *in situ* and subsequently dissected. Of two other animals, one died on 9 June and on 26 June the other laid two ellipsoidal eggs which were pale yellow, translucent and measured 1·3 × 0·9 mm., with a finely granular surface.

Gerhardt considered the mobile organ to be a penial appendage, and stated that the penis entered the partner's vagina, but dissection of my fixed animals showed clearly that it is the everted vagina, and that the tip is the spout at the end of the globular oviducal swelling. Obviously, therefore, the penis did not enter the vagina as Gerhardt assumed, but what it entered was a pocket or recess of the atrium, and sperms deposited therein would only reach the oviduct and spermatheca after the withdrawal of the organs. Forcart also adopts this interpretation. In *Agriolimax* the sarcobelum is a penial accessory, but sperm is deposited on the partner's everted organs and so, as in *V. major*, only reaches the spermatheca after withdrawal. A somewhat similar transfer of sperm occurs in *Limax*. One other instance of the everted oviduct functioning as a stimulatory organ has been reported, and that in quite a different genus, namely in *Arion hortensis* (Quick, 1946, *J. Conch.* **22**, 178).

ADDENDUM.—On 29 May 1957 I paid a visit to Sheep Leas and, after vainly searching for two hours, found one living *V. major* under a log. Within half an hour about 20 recently dead shells, some still containing remains of the soft parts, were found amongst the litter of dead beech leaves, all within a yard or two of this spot, but no further living example was seen. The one first found was evidently moribund, as it refused to expand even when immersed in water. It was dissected and the identification confirmed by Dr. Quick.

A. E. ELLIS.

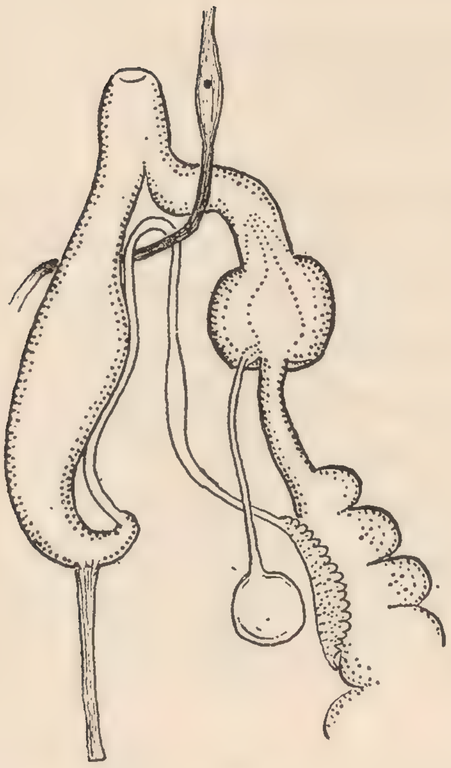


FIG. 1.—*Vitrina major* :
Distal genital ducts (× 8).

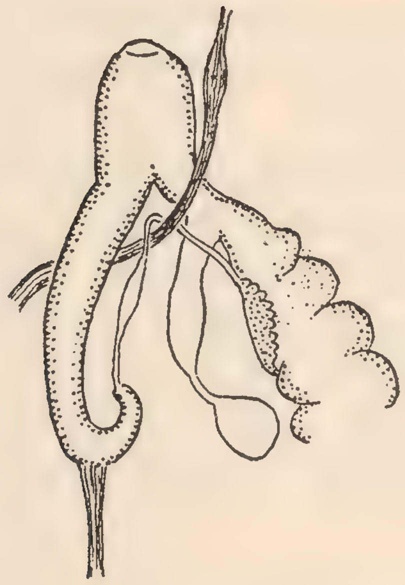


FIG. 2.—*Vitrina pellucida* :
Distal genital ducts (× 8).

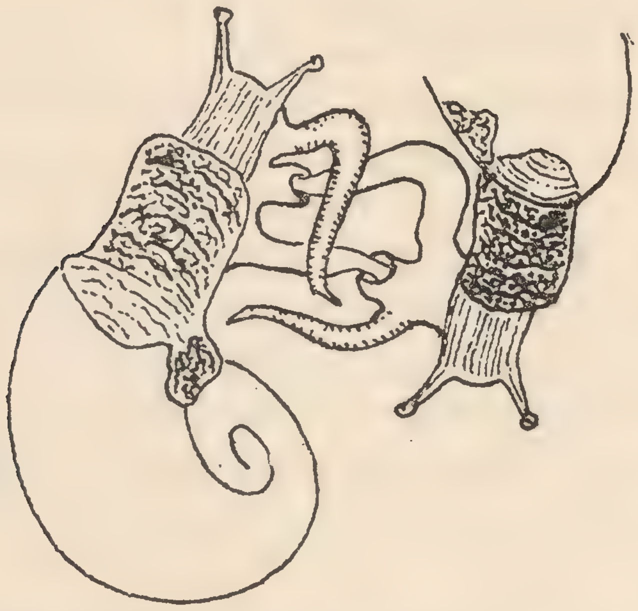


FIG. 3.—*Vitrina major* in copula.

A large example of *Potamopyrgus jenkinsi* (Smith).—At the south-western end of North Bull Island in Dublin Bay are a number of brackish pools. On 25 March 1957 I was working this area for Mollusca and from one of these pools took a small number of the above species. Amongst them was one shell measuring 8·6 × 3·2 mm. Most writers seem to consider that this species normally measures about 5·5 × 3·0 mm. The remaining 13 examples of the series I took average 6·11 × 3·03 mm.

H. E. J. BIGGS.

(*Read before the Society*, 18 *May* 1957)

THE MOLLUSCAN SEQUENCE IN THE LEA VALLEY

By JOHN F. HAYWARD, Ph.D., M.Sc., F.G.S.

(*Read before the Society*, 13 *April* 1957)

As a result of work by various authors in the last century, by Mr. S. Hazzledine Warren since 1900, and by the present writer in recent years [for references see Hayward, 1957*a*], much is known concerning the sequence of deposits in the Lea Valley since Late Glacial times. In some cases large faunal lists have been quoted, not always from material obtained *in situ*, and though these, being part of the evidence, cannot be ignored, they tend to be a burden rather than a help to workers. Consequently, it now seems desirable to divide the history of the Lea—excluding the earlier phases which are still uncertain—into a number of stages, each of which is defined as clearly as possible. Reference to the more salient species of mollusc is made.

The species of *Pisidium* are, with one exception, omitted, as also are those of *Succinea* (since identification of these last in the absence of soft parts is in doubt). Certain land genera, including the slugs, are also omitted or are not quoted by species.

Passing over the earlier phases pending further investigations, it is now possible to bridge the events from the Late Glacial to the present day by five stages. These may be regarded alternatively as divisions of time or as stratigraphical units, though it is rare for deposits of all five stages to be found in superposition :—

5. The Historical Stage.
4. The Rammey Marsh Stage.
3. The Boreal-Atlantic Stage.
2. The Nazeing Stage.
1. The Ponders End Stage.

1. THE PONDERS END STAGE.

The Ponders End Arctic Bed was first described by Warren [1912, 1916] from Pickett's Lock Pit, Edmonton, and elsewhere. It has been subsequently proved from Nazeing to Stratford. The term " Ponders End Stage " has since been used by Warren to describe the whole of the gravel in which the Arctic Bed is included, and the term is best used, in the area stated above, to describe that stage in the history of the River Lea which includes the deposition of the whole of the gravels lying on the Eocene Beds in the Flood Plain, but not the basal gravels of the next (Nazeing) Stage. The Ponders End Stage is Late Glacial in age.

The critical mollusc species are :—

Planorbis laevis Alder.
Columella columella (Benz).
Vertigo parcedentata (Braun).
Pisidium obtusale lapponicum Clessin.

Other species which continue until the present day are :—

Valvata piscinalis (Müller).
Lymnaea truncatula (Müller).
Lymnaea palustris (Müller).
Lymnaea stagnalis (Linné).
Lymnaea peregra (Müller).
Planorbis leucostoma Millet.
Planorbis crista (Linné).
Planorbis contortus (Linné).
Pupilla muscorum (Linné).
Sphaerium corneum (Linné).

2. THE NAZEING STAGE.

This was first described by Warren (Allison *et al.* 1952) from the type locality at Nazeing. The deposits of this stage were first found outside the type area by the author (Hayward 1957*a*) and a definition of the stage was later given in agreement with Mr. Warren (Hayward 1957*b*). The stage was initiated in Late Glacial times and continued into the Post Glacial.

The molluscs listed above from the Ponders End Stage were still found, with the exception of *Vertigo parcedentata*, which was not recorded from Nazeing. In addition there were the following newcomers :—

Bithynia tentaculata (Linné).
Physa fontinalis (Linné).*
Planorbis planorbis (Linné).
Cochlicopa spp.
Vallonia spp.
Hygromia hispida (Linné).

3. THE BOREAL-ATLANTIC STAGE.

The Nazeing Stage was followed by extensive peat formation in the valley. The earlier peat is certainly of Boreal age and it would seem that part also of the Atlantic stage is represented in the peats of the Lea Valley. But much work needs to be done to clarify the ages of the various deposits.

The beginning of the Boreal was marked by the loss of *Columella columella* and *Pisidium obtusale lapponicum* and by the appearance of a large number of new species. The following are of temporary importance :—

Ena montana (Draparnaud).
Clausilia bidentata (Ström).
Discus ruderatus (Férussac).

The following species appeared during the Boreal and are still to be found in the valley :—

---

* This species was not recorded from the type site at Nazeing.

Valvata cristata Müller.*
Carychium spp.
Aplexa hypnorum (Linné).
Segmentina sp. or spp.*
Acroloxus lacustris (Linné).*
Vertigo spp.
Arianta arbustorum (Linné).
Helix hortensis Müller.
Helix nemoralis Linné.
Punctum pygmaeum (Draparnaud).
Euconulus fulvus (Müller).
Retinella spp.
Zonitoides nitidus (Müller).

4. The Rammey Marsh Stage.

The deposits of this stage were first described from Rammey Marsh, Waltham Cross, on the Hertfordshire–Middlesex–Essex border (Holmes and Hayward 1955, Hayward 1957*a*). An up-to-date assessment of the stage is being prepared for publication. In the meantime the following definition is offered : " That stage in the history of the River Lea which was initiated by the erosion of a navigable channel in probably the fifth century B.C. and which continued until the channel was completely filled by a characteristic type of deposit, largely calcareous but in places peaty. The stage probably continued until about the end of the first millenium A.D."

Two species peculiar to the previous stage, *Ena montana* and *Discus ruderatus*, had disappeared, as also had the Glacial *Planorbis laevis*. *Planorbis acronicus* Férussac and *Bithynia leachi* Sheppard appeared during the stage, possibly by human introduction (Holmes and Hayward 1955). The former probably died out immediately and the latter established itself, but deposits of the Rammey Marsh Stage may nevertheless be free from either species. *Clausilia bidentata* persisted but it did not survive into the next stage. Other new molluscs were :—

Theodoxus fluviatilis (Linné).
Planorbis carinatus Müller.
Planorbis vortex (Linné).
Planorbis albus Müller.
Ancylus fluviatilis Müller.
Discus rotundatus (Müller).
Vitrea crystallina (Müller).

5. The Historical Stage.

The whole of the history of the Lea since the close of the Rammey Marsh Stage is included in the Historical Stage, now named for the first time. Certain deposits of that stage were described by the writer (1957*a*, pp. 48 *seq.*) but much remains to be done. So far as the Mollusca are concerned there are two sub-stages, the pre-Canal Phase and the Canal Phase.

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* These three, which are typical of the Boreal, appeared very late in the Nazeing Stage.

The Lea was linked with the network of canals in the early nineteenth century, though navigation via the Thames existed earlier. This commerce seems to have encouraged an influx of new species, though a few of these may have arrived earlier in small numbers. It may be that a third substage is in the course of initiation due to the reduction of species by industrial effluents. When the Conchological Society visited Broxbourne in 1955 under the leadership of Mr. L. W. Stratton, certain species were not found in stations from which they had been previously recorded.

The characteristic new species of the Historical Stage are :—

(*a*) *The pre-Canal Phase.*

Lymnaea auricularia (Linné).
Planorbarius corneus (Linné).
Hygromia liberta (Westerlund).
Anodonta minima Millet.

The last quoted was undoubtedly a chance introduction which did not succeed in populating the river.

(*b*) *The Canal Phase.*

Viviparus viviparus (Linné).
Potamopyrgus jenkinsi (Smith).
Monacha cantiana (Montagu).
Unio pictorum (Linné).
Unio tumidus Philipsson.
Anodonta cygnea (Linné).
Anodonta anatina (Linné).

The details of the phenomenal spread of *P. jenkinsi* from brackish to fresh water are well known (Ellis 1926).

Although the lists given above are not complete and may require slight modification in the light of later work, the writer believes that they provide a reliable working basis for the identification of horizons within that part of the Lea Valley below Ware. They indicate how the molluscan fauna of the valley, as listed by Stratton (1955), has been built up since Late Glacial times.

The writer is indebted to Mr. S. Hazzledine Warren for discussing the paper with him.

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THE RADULA OF *CANCELLARIA*

By K. H. Barnard, South African Museum

(*Read before the Society*, 18 *May* 1957)

A specimen of *Cancellaria* dredged alive off the coast of South West Africa was recently submitted to me for identification. It agrees with specimens obtained by the Belgian Oceanographical Expedition in (approx.) 5½°–6½° S. lat. 11½° E. long., and referred by Adam & Knudsen (1955, *Bull. Inst. Roy. Sci. nat. Belge.* **31**, no. 61, p. 16, pl. 2, figs. 6, 7, and text-fig. 4) to the Italian Pliocene-Miocene species *lyrata* Brocchi. It agrees also, but not exactly, with a Cape Verde specimen referred by Dautzenberg & Fischer (1906, *Res. Sci. Camp. Monaco.*, fasc. 32, p. 17, pl. 1, figs. 11–13), likewise to the fossil *lyrata*.

Adam & Knudsen described the anatomy of one of their specimens, including the radula and " mandible ". My specimen unfortunately was so contracted and hardened that dissection was impossible ; by prolonged soaking in caustic potash, however, the radula and mandible were extracted at the sacrifice of the operative muscles.

I have seen Thiele's discussion of the *Cancellaria* radula, but not the earlier works of Troschel, Bouvier, or Amaudrut quoted by him (1903, *Deutsch. Tiefsee Exp.* **7**, p. 171, pl. 9 (4), figs. 69, 70) ; I can only record my own observations.

The so-called jaw or mandible has the same shape as that figured by Thiele, if flattened out ; actually it forms a sheath, somewhat like a crustacean carapace, and the pointed anterior portion is tubular, with a small apical opening. The shape of the mandible as described by Adam & Knudsen is quite different. In addition to the main sheath, there is an inner smaller sheath, which seems not to have been observed by Thiele in his material. The radula corresponds with Thiele's description, being composed of a large number of very slender elongate teeth attached in single file to a basal membrane ; and likewise in two groups diverging in opposite directions.

When *in situ* the bunch of teeth on the shorter anterior portion of the basal membrane was lying in the tubular portion of the main sheath, and by gentle pressure some of them could be protruded through the apical opening. The teeth of the posterior bunch were mostly bent or crumpled distally, appearing as if they were kept in reserve as replacers. The hindermost teeth were obviously nascent, being pale and feebly indurated.

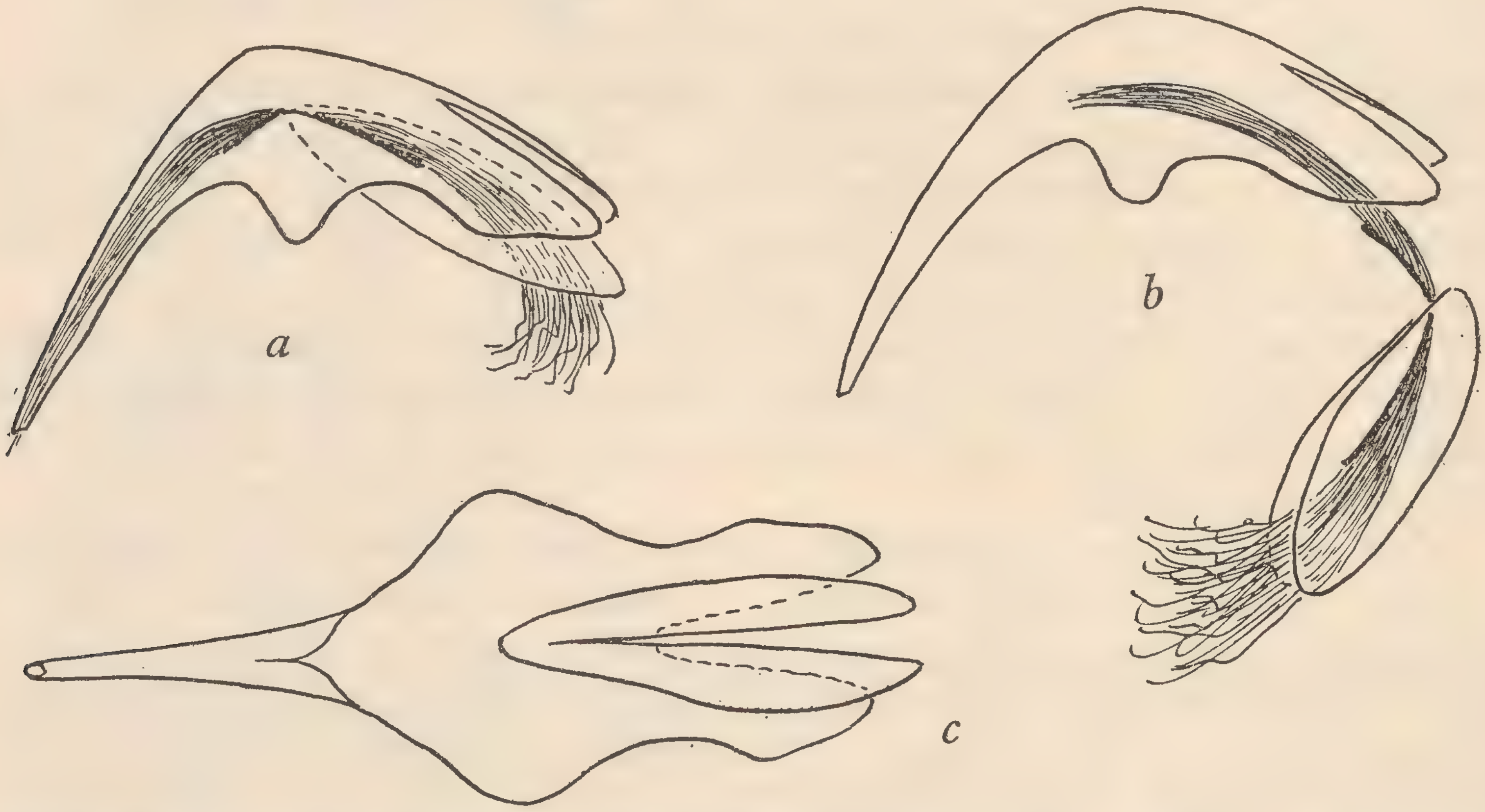
Without further material and a study of the myology, one can only speculate on how this peculiar structure operates. If it were pushed forward into the mouth, the anterior bunch of teeth might be protruded through the opening of the tubular part of the sheath, which would hold the teeth firm like the hairs in the collar of a paint-brush, and used to sweep particles of food into the mouth.

The teeth of my specimen correspond with those described by Adam & Knudsen.

I have also examined a specimen of *Cancellaria imbricata* Watson in the South African Museum, but the animal was in such a decomposed condition that only the radula was obtained; no sheath was observed. The teeth, however, were arranged in single file in two divergent groups on the basal membrane, as in the other specimen. In both cases there are at least 100 teeth.

I have found exactly the same structure of a double sheath surrounding the radula in a single specimen of *Cancellaria lamellosa* from Delagoa Bay, but the soft tissues of the animal were too decomposed for study.

A similar change in orientation occurs in the elongate lateral plates of *Drupella* Thiele, 1925, the plates projecting backwards on the posterior two-thirds of the radula, and forwards on the anterior third.



Cancellaria cf. *lyrata* Brocchi: (*a*) sheath with radula after clearing in potassium hydroxide; (*b*) inner sheath pulled out; (*c*) ventral view of the two sheaths (radula omitted).

***Monacha cantiana* (Montagu) in Pembrokeshire.**—In July 1957 I found *M. cantiana* living among nettles and long grass on roadside verges in and about the village of St. Ishmaels, Pembrokeshire. The colonies were well established, but judging from the complete absence of the species in wild places away from the roads, it would appear that *M. cantiana* has reached this remote area, its most westerly station in Great Britain, only in recent years. The immediate neighbourhood is underlain by Old Red marls and by Upper Silurian mudstones and flags, both series being somewhat calcareous.

M. P. Kerney.

(*Read before the Society*, 19 *October* 1957)

PISIDIUM CONVENTUS CLESSIN IN LOCH LOMOND

By W. Russell Hunter and H. D. Slack

Department of Zoology, University of Glasgow

(*Read before the Society*, 19 *October* 1957)

Although much of the northern part of Loch Lomond has water depths of over 525 feet (160 m.) and one extensive depression (the "Tarbet deep") reaches 620 feet (190 m.), little was known of the bottom fauna in those depths until comparatively recently. Between 1949 and 1955 a small number of samples was collected, mostly by dredge, and since October 1955 a monthly series of quantitative samples have been made from the mud of the deepest trough, using a Petersen grab. The fauna is poor: numerical densities both of species and of individual animals are very low.

Only two specimens of *Pisidium* have been found. The first was dead when taken by dredge and, though it was destroyed during preparation of the shell, seemed exactly similar to (but slightly larger than) the second specimen. This was taken alive in a regular grab sample on 19 November 1956, and has been identified as *Pisidium conventus* Clessin (we are indebted to Mr. A. E. Ellis for verifying this determination).* *P. conventus* is an uncommon species of limited distribution in Britain (Ellis 1951), being more typical of Swedish lapland and arctic Norway, and occurring as the only molluscan species in the fresh waters of Novaya Zemlya (Odhner 1923). Odhner considers it a true arctic species, limited in the southern part of its range (i.e. in central Europe and the Alps) to the "cold regions of deep lakes". The records from the British Isles are more for localities in mountain lakes at altitudes around 2,000 feet (e.g. in Co. Kerry, in Snowdonia and in the Lake District—Ellis 1940). In Scotland, the species has been found at a depth of 400 feet (122 m.) in Loch Ness (see Oldham 1932), and has also been recorded from a smaller hill loch in Inverness-shire, Loch cé Glais, from Loch Vennacher and more recently from Loch Choin (altitude *ca.* 1,200 feet) near Pitlochry (Ellis 1953) and Loch Rannoch (Dance 1957).

Apart from *P. conventus*, the animals so far collected from the deepest part of Loch Lomond are chironomid larvae of the genera *Endochironomus*, *Cryptochironomus* and *Procladius*, and tubificid worms. From 42 grab samples (three make up each monthly sampling) the average density has been 1·2 animals per grab (equivalent to 32 animals per square metre of the bottom). In the southern part of Loch Lomond densities of 6,000 animals per square metre are found on the bottom in depths of less than 13 feet (4 m.). *Pisidium* spp. can reach densities of 400 per square metre in southern Loch Lomond, that is, occur at densities possibly 600 times greater than that of *P. conventus* in the Tarbet deep. It is of some significance that specimens of *Pisidium* from the profundal fauna of the moderately deep basin in southern Loch Lomond (the "Luss basin"), from depths of around 200 feet (60 m.), have proved to be *P. casertanum* (Poli), a species abundant throughout the loch in shallower water. If *P. conventus* is limited, as seems likely, to the northern part of the loch and to the Tarbet deep, this will present a species-distribution very unusual for Loch Lomond. In general, the southern or " Lowland " part of the loch contrasts with the northern or " Highland " part in having greater faunal densities and a greater number of species (Slack 1957*b*). This can be illustrated by the freshwater snails : fourteen species occur in the Lowland section, but only seven of them have been found to extend into the Highland section (Hunter 1957). Although a survey of bivalves in Loch Lomond by one of the present writers (W.R.H.) is still far from complete, it is likely that *Pisidium amnicum* (Müller) and *P. henslowanum* (Sheppard) (see Hunter 1955) are even more limited in distribution, occurring only in the southernmost part of the Lowland section. The less usual limitation of a species to the deepest water of the Highland section of the loch is significant. The bottom deposits of the Tarbet deep compared with those of the Luss basin show a greater organic content, and a higher carbon/nitrogen ratio, indicating slightly greater dystrophy (Slack 1954). But perhaps the most distinctive feature of the environment in which *P. conventus* occurs is that the water temperature at the bottom of the Tarbet deep is low and limited in annual range (4·7° to 6·4° C. from records taken each month from June 1953 to May 1957 : Slack 1957*a*, and unpublished records).

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* A third specimen of *P. conventus* was taken by Petersen grab in October 1957.

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ADDENDUM.—For the purpose of recording *Pisidium conventus* from Loch Lomond in the Conchological Society's Census of Distribution of non-marine Mollusca, it has been assigned to Dunbarton (99) as most of the loch lies within this county. The boundary passes through the middle of the part of the loch where *P. conventus* was dredged, so the species might with equal justification be assigned to Stirling (86). Subsequent investigations may definitely establish the occurrence of *P. conventus* on both sides of the county boundary.

A. E. E.

PISIDIUM FROM HIRTA, ST. KILDA

By W. Russell Hunter and J. D. Hamilton

Department of Zoology, University of Glasgow

(*Read before the Society*, 19 *October* 1957)

This note reports on a small collection of *Pisidium* made on Hirta, the main island of the St. Kilda group, in June 1956. The specimens were collected by one of the present writers (J.D.H.) while making collections of other freshwater fauna, which will be reported on elsewhere; and prepared, sorted and determined by the other (W.R.H.). Acknowledgments must be made to the late Marquis of Bute, then proprietor of the islands, for permission to collect there, and to Mr. A. E. Ellis for confirming the identification of typical specimens of the two species noted below and also for assigning certain doubtful specimens to *Pisidium casertanum* (Poli).

A total of 67 specimens was collected from the following localities :—

(*a*) Tobar Nam Buaidh : a peaty pool about 5 yards in diameter and 10 inches deep, almost entirely filled with *Potamogeton* sp. and *Callitriche* sp.

(*b*) A tributary to the stream, Amhuinn a'Ghlinne Mhoir, running from the region of Amazon's House ; only a trickle of water in June 1956.

(*c*) Several marsh pools behind a storm beach, fed by water from Amhuinn Riasg and a stream from Tobar Chonastan.

(*d*) The tarn in Gleann Mor : a larger peat pool about 18 yards by 11 yards and 18 inches deep, with open water, reeds and sphagnum moss round the margin.

The majority (64) of the specimens proved to be *Pisidium casertanum* (Poli), which species was present in each locality-collection. Several specimens of this species, with shell lengths of around 3·3 mm., contained five or six fry, each about 1 mm. long. The remaining three specimens, identified as *P. hibernicum* Westerlund, were taken in the Gleann Mor tarn (locality (*d*) above). Bivalves were most abundant in locality (*a*), and fewest were found in stream (*b*). Both species have been recorded for the Outer Hebrides (Ellis 1951) and occur, for example, in several localities in Barra (Forrest, Waterston and Watson 1936). The only previous record of *Pisidium* from Hirta is that of Waterston and Taylor (1906), thus dating from before the revision of the systematics of the genus in Britain by Stelfox, Oldham and Phillips. Waterston and Taylor report " *P. pusillum* (Gmel.) " as being abundant in " marshy ground at the foot of Avon Mhor ", stating that their specimens were " referable to var. *obtusale*, though not strictly characteristic ". It is impossible to state with any finality which species they did collect as, although the name " *P. pusillum* " was attached by Woodward particularly to *P. nitidum*, authors up to 1917 applied the name to a variety of species (see Stelfox 1918*a–b*; Phillips and Stelfox 1918). Their specimens could have been either of the species collected in 1956 or some other species not collected. *P. casertanum* is ubiquitous and euryoecic in the Hebrides, as it is throughout Britain. *P. hibernicum* seems to be less generally distributed in the Outer Isles but it can colonize the " peatiest " of lochans, and occurs at all altitudes from sea level to the highest tarns in Ireland and Wales (Phillips and Stelfox, 1918). It is worth noting that no freshwater snails were found on Hirta in 1956, and none has ever been recorded there. Considering the fauna in general, the fresh waters of Hirta support a relatively small number of invertebrate species, and all that do occur are forms ubiquitous in the British Isles. The species-distribution of *Pisidium* does not reflect in any way the degree of isolation shown by the St. Kilda group. This is what might be expected in a genus so readily the subject of passive dispersal over long distances.

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Dixon and Watson's *Descriptive Manual of British Land and Fresh-Water Shells*.—With reference to Mrs. N. F. McMillan's account in this Journal (**24,** 209) I have two copies of version (*a*). Both agree with that described by Mrs. McMillan, except that one has BRITISH SHELLS blocked in gold on the spine. I also possess a copy of version (*c*) in brown paper cover which agrees with that described with the exception of a misprint on the cover, viz. " Dickson & Watson's " instead of " Dixon & Watson's ". The edition is undoubtedly octavo (= 8 leaves to a sheet) and not duodecimo (= 12 leaves to a sheet) as indicated at the foot of certain pages.

J. WILFRID JACKSON.

A NEW SPECIES OF *SIPHONARIA* FROM THE PERSIAN GULF

By Rev. H. E. J. Biggs, F.L.S.

(*Read before the Society*, 17 *November* 1956)

Siphonaria asghar sp. nov. Shell patelloid, small, medium height, with 51 radial ribs, which are larger and stronger at the posterior end ; syphon groove not well defined ; apex of shell central ; shell pale greenish-brown, apex same colour except where worn ; interior of shell mostly chestnut brown except for edge, which is white, but in places streaks of brown extend to margin. Length 11·2 mm., breadth 9·1 mm. Holotype in my collection with six paratypes collected on rocks on Hormuz Island, Persian Gulf, 12 May 1933.

There are five specimens in the British Museum collection from Bushire, Persian Gulf, W. D. Cuming collection. Under the box J. R. le B. Tomlin has written in pencil " ? *sipho* ". I think these specimens can be considered to belong to the proposed new species, but may be between this and *S. sipho* Sowerby. The new species bears little resemblance to any other specimens I have seen from the Persian Gulf, but seems to come nearest to *S. tenuicostulata* Smith from Natal, and indeed may prove to be a northern form of this species ; we need to see examples from the coasts between. It differs from the Natal species in that the costae are smaller and closer ; the head-scar is not pearly white as in *S. tenuicostulata.* Furthermore, in the latter species the interior brown colour runs right to the edge of the shell, giving it a striped appearance, whereas in the proposed new species it does so only in a few places and scarcely at all in most of the paratypes.

I have chosen the name *asghar* (Arabic, smaller) as it is generally smaller than the two nearest species, *S. sipho* Sowerby and *S. tenuicostulata* Smith.

The six paratypes have a few small details in structure which should be mentioned. In some the apex is not central and some are more trapezoid than oval like the type. The average measurements for the paratypes are 10·3 × 7·9 mm. The average number of ribs for the holotype and paratypes is 46.

There are five examples of a species of *Siphonaria* from Muscat in the Townsend Collection in the British Museum, also very near this species and so far unnamed. The proximity of Muscat to Hormuz Island and the similarity of the examples leaves little doubt in my mind that they are conspecific with *S. asghar*.

ON THE OCCURRENCE OF *MARGARITIFERA AURICULARIA* (SPENGLER) IN THE ENGLISH PLEISTOCENE

By M. P. Kerney

(*Read before the Society*, 19 *October* 1957)

Margaritifera auricularia (Spengler) was first recorded from Britain in 1909 by Jackson and Kennard, under the name of *Unio margaritifer* var. *sinuata* Lamarck, from gravels in the bed of the Thames between Mortlake and Hammersmith. The exact age of these shells is uncertain, since all were dredged, but associated blocks of cemented gravel yielded a freshwater fauna of distinctly Holocene type (Kennard and Woodward, 1913), and the deposits were said to contain Neolithic polished axes. From the apparent absence of juveniles and of united valves Kennard considered that the mussels had not lived where found, but represented human food-debris (Kennard, Salisbury and Woodward, 1925, pp. 278–9).

M. auricularia can now be recorded from the English Pleistocene. In February 1957 a temporary section in terrace deposits of the Thames was opened in Trafalgar Square, London, and the Mollusca were studied by the late A. G. Davis and the writer. All the larger bivalves were exceedingly fragile and difficult to collect, but some fragments were recognized by Mr. Davis as probably belonging to *M. auricularia.* Later two fairly complete left valves undoubtedly of this species were obtained. The larger of these measures 120 mm. (approx.) × 75 mm. and is very thick and massive, relatively more so than any of the Mortlake shells, and compared with them is rather less elongate and scarcely shows the characteristic sinus in the ventral margin.

The Trafalgar Square sands and gravels form part of the Upper Flood Plain Terrace (Last Interglacial), with a local aggradation surface at 20 feet O.D. +, and rest on a bench cut in London Clay at − 8 feet O.D. The fauna and flora are of warm-temperate type, including *Hippopotamus amphibius* L., and, among the common Mollusca, *Belgrandia marginata* (Michaud) and *Potomida littoralis* (Cuvier). A full account of this important site is being prepared for publication elsewhere.

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NOTE ON *PETRICOLA PHOLADIFORMIS* LAMARCK

By E. St. John Burton

(*Read before the Society*, 19 *October* 1957)

In 1907 an article appeared in *Country Life*, by J. E. Cooper, with the title of "Immigrant Shell-fish". Among these was *Petricola pholadiformis.* It is the purpose of this note to give some account of the present distribution of the above species in Christchurch Bay, Hampshire, and also at Hengistbury Head, situated at the south-west end of the bay. In each case colonies exist at the present time.

It is uncertain when *P. pholadiformis* arrived along this part of the coast, but to the knowledge of the writer colonies were well represented by fully grown examples of the species about 100 yards eastward of Hengistbury Head as long ago as 1904, and may be well represented at the present time.

Eastward of this point, and about 200 yards west of Barton Gang at Barton-on-Sea, there is a colony, noticed by the writer, and composed mostly of immature examples of *P. pholadiformis*, but no colonies east of that point, although the clays of the Middle Barton Beds are quite often exposed on the shore at low spring tides.

The manner of occurrence of *Petricola* is somewhat peculiar, because instead of boring into clay at shore level the shells are always crowded into blocks of clay separated by channels caused by wave-action. At low-water these are well seen. Similar features are observed just east of Barton Court, but without any boring Mollusca. In the former case, penetration is very thoroughly carried out by almost countless numbers of *P. pholadiformis*, all being juveniles. The blocks of clay are not more than 2–3 feet in length, and half that measurement in height. They belong to the Middle Barton Beds, mostly composed of rather hard brownish-grey clays.

Observations made by the writer show that these juvenile shells seem to prefer this clay to the glauconitic clays which immediately underlie the clay mentioned earlier, where not a specimen is to be found. The juveniles mentioned are crowded together and disposed at all angles; they are naturally very fragile, but such conditions of life demonstrate the great productivity of the species. It hardly seems possible that these delicate shells could survive such crowded conditions for very long.

With reference to Bournemouth (Poole) Bay (Ordnance Surv. Sheet 329), this extends westward for a distance of 9 miles, and the shore is composed throughout of sand, with occasional flint stones in places. Clay is not exposed. In former years many beautiful shells comprising a number of genera were frequently cast ashore, especially near the sand-banks at the western end of the bay; but since the construction of the esplanade at Bournemouth such happy conditions were destroyed.

The possibility of *P. pholadiformis* occurring on the northern shores of the Isle of Wight should not be ignored, for the clay-shores at Bouldnor and at Hamstead Cliff might perhaps provide suitable conditions; but the writer has not found the opportunity to explore these localities. It does not follow, however, that exposures of clay, which occur so widely at Bouldnor, would harbour *P. pholadiformis*, because at Barton itself the species does not bore into many of the clays and seems confined to certain restricted conditions.

ACANTHINULA LAMELLATA (JEFFREYS) IN PEMBROKESHIRE

By L. Lloyd-Evans

On 26 July 1957 nine specimens of *Acanthinula lamellata* were found on dead leaves and fallen branches in Goultrop Wood near Talbenny, Pembrokeshire (National Grid SM 843125).

The wood lies on north-facing sea cliffs of intrusive pre-Cambrian rock overlooking Goultrop Roads at the south-east corner of St. Brides Bay; the slope is steep enough to make grazing unsafe and felling uneconomic, and the resulting fine natural oakwood is scheduled for preservation by the Nature Conservancy. The tree layer consists of sessile oak (*Quercus petraea*) with occasional birch (*Betula pubescens*) and aspen (*Populus tremula*); there is a scanty shrub layer of hazel (*Corylus avellana*), holly (*Ilex aquifolium*) and sallow (*Salix caprea*), and the ground layer is dominated by *Luzula sylvatica*. Humidity is high in the wood and the trees have their branches covered with ferns, mosses and lichens.

Associated Mollusca in the wood were *Carychium tridentatum*, *Cochlicopa lubrica*, *Lauria cylindracea*, *Acanthinula aculeata*, *Clausilia bidentata*, *Balea perversa*, *Arianta arbustorum*, *Helix hortensis*, *H. nemoralis*, *H. aspersa*, *Hygromia subrufescens*, *H. hispida*, *Discus rotundatus*, *Arion intermedius*, *A. circumscriptus*, *A. subfuscus*, *A. ater*, *Euconulus fulvus*, *Vitrea crystallina*, *Oxychilus cellarius*, *O. helveticus*, *Retinella radiatula*, *R. pura*, *R. nitidula*, *Vitrina pellucida*, *Limax cinereoniger*, *L. marginatus* and *Agriolimax reticulatus*.

Acanthinula lamellata has not previously been recorded from Pembrokeshire; Mr. A. E. Ellis, to whom I am indebted for confirming the identification of the snails, informs me that *Oxychilus helveticus* has previously been recorded from the county but not authenticated, and *Retinella pura* is a new record for the county; the form occurring in Goultrop Wood is the pale horn-coloured variety referred by Gray to *nitidosa* Férussac.

EXTENSION DU GASTROPODE MÉDITERRANEEN, *COCHLICELLA ACUTA* (MÜLLER), DANS LE SUD-EST DE L'ANGLETERRE

Par M. De Leersnyder et H. Hoestlandt

Laboratoire de Zoologie de la Faculté libre des Sciences de Lille (France)

(*Read before the Society*, 19 *October* 1957)

En 1930, D. Aubertin, A. E. Ellis, et G. C. Robson publiaient un article abondamment documenté sur la situation d'un Mollusque terrestre d'origine méditerranéenne, *Cochlicella acuta* (Müller), dans les Iles Britanniques et en particulier aux environs de Brighton (limite Sud-Est de l'extension de ce Mollusque à cette époque). Ces auteurs donnaient également quelques indications sur la durée de vie de ce Pulmoné. Dans le présent article, après quelques données générales sur l'espèce, la situation actuelle de ce Gastropode dans le Sud-Est de la Grande Bretagne sera examinée à partir des prospections effectuées par nous en 1956 et des renseignements aimablement communiqués par Messieurs J. P. T. Burchell, C. P. Castell, A. G. Davis, A. E. Ellis et H. Watson ; enfin l'étude graphique des populations permettra d'aborder à nouveau le problème de la longévité de cette espèce.

I. — DONNEES GENERALES SUR *COCHLICELLA ACUTA*

Cochlicella a d'abord été defini par Férussac (Jan. 1821, 56) comme un sous-genre d'*Helix* ; Risso (1826, 77) en fit un genre nouveau. Celui-ci se caractérise par un aspect conique ou turriculé de la coquille, par des tours de spire nombreux, étroits et non carénés, par une columelle torse et creuse et par un ombilic tres réduit.

Ce genre renferme actuellement trois espèces : *acuta* Müller 1774, *ventricosa* Draparnaud 1801 et *conoidea* Draparnaud 1801. L'espèce *acuta* est la plus répandue ; bien qu'elle ait été peut-être décrite par Linné lui-même en 1758 sous le nom d'*Helix barbara*, il n'a pas été possible de retenir cette dénomination car les caractères donnés par Linné sont insuffisants pour définir l'espèce envisagée.

Cochlicella acuta possède une coquille allongée, comportant 9 à 11 tours de spire, à test peu strié ; *Cochlicella ventricosa* montre une coquille moins élancée que l'espèce précédente, avec 7 tours de spire environ et un test plus fortement strié. Ces deux espèces se distinguent également entre elles par les dépendances appendiculaires de l'appareil génital : simples ou bifurquées chez *C. acuta*, divisées en quatre branches chez *C. ventricosa* (Adam, 1947*a*). La troisieme espèce, *Cochlicella conoidea*, est nettement " conoide " et globuleuse avec un dernier tour fortement renflé.

Ces trois espèces vivent généralement au voisinage de la mer, mais pénètrent nettement à l'intérieur du territoire dans les îles. Elles sont d'origine méditerranéenne, mais se sont étendues aux côtes atlantiques de la Péninsule Ibérique. Seule l'espèce *acuta* s'est répandue sur les autres côtes atlantiques de l'Europe (France, Iles Britanniques), atteignant la Belgique, l'Irlande et même l'Ecosse (Ellis, 1951) ; contrairement à des affirmations antérieures, elle n'a pas atteint les côtes de l'Allemagne (Boettger *in litt.*), ni celles de la Scandinavie (Mandahl-Barth *in litt.*). Sur les côtes américaines, l'espèce est répandue aux Etats-Unis, aux Bermudes, dans la Caroline-Sud et la Californie (Pilsbry, 1939). Il faut signaler la découverte exceptionnelle de *Cochlicella ventricosa* à la limite Ouest de la côte belge, à la Panne, en 1947 (Adam, 1947*b*), mais cette petite station accidentelle disparut aussitôt à la suite d'un hiver rigoureux suivi d'un été excessivement sec. L'espèce est trouvée à nouveau par l'un de nous en Juin 1957, sur la côte française de la mer du Nord, en une station importante et prospère qui sera étudiée en détail ultérieurement.

II. — SITUATION ACTUELLE DANS LE SUD-EST DE LA GRANDE-BRETAGNE

HISTORIQUE

Par une communication de Castell (1949), on sait que *Cochlicella acuta* atteignait l'East Kent à la période Saxonne : trois spécimens subfossiles furent ramassés par le Major Burchell à West Hythe (Fig. 1).

A la fin du siècle dernier, l'espèce ne dépasse plus la région d'Hastings. Jenner en 1882 (d'après Toms, 1922) trouve cette espèce à Ore près d'Hastings, ainsi qu'à Mill Gap près d'Eastbourne. En 1922, ces colonies

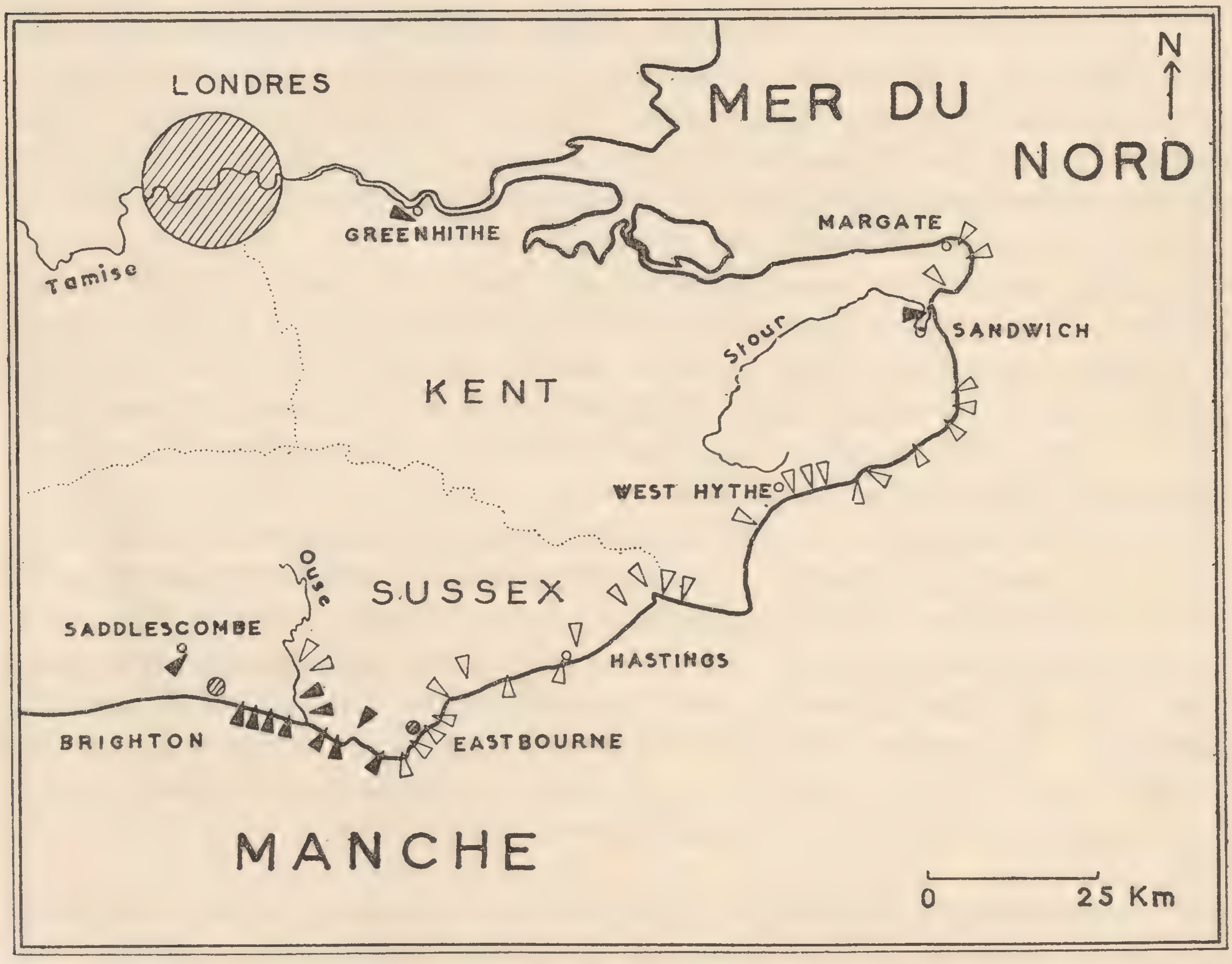

FIG. 1.—Carte des stations de *Cochlicella acuta* à la limite d'extension vers le Nord-Est. La pointe des triangles indique les stations : les triangles pleins signalent la présence de *Cochlicella acuta*, et les triangles vides son absence.

ont disparu ; elles ne sont retrouvées ni en 1930 par Aubertin, Ellis et Robson, ni en 1956 par nous-mêmes.

En 1917, Miss Robinson (d'après Toms, 1922) signale *Cochlicella acuta* dans la région de Brighton au hameau de Saddlescombe (Fig. 1) situé à 6 kilomètres au nord de la ville ; c'était, à cette date, la limite vraisemblable d'extension vers le Sud-Est de l'Angleterre. Cette station a été retrouvée par Toms en 1919 (Toms, 1922) puis par Aubertin, Ellis et Robson (1930), enfin par nous-mêmes l'année dernière. Actuellement la population y est importante avec tendance à l'extension comme nous l'exposerons plus loin.

A l'Ouest de Brighton, deux stations ont été signalées à Burpham et à Amberley par Aubertin, Ellis et Robson (1930). Ce sont les témoins d'une aire de répartition qui s'étendait, entre 1854 et 1870, de l'Adur à Chichester. A l'Ouest de la vallée de l'Arun, si l'on excepte la station de Freshwater dans l'île de Wight, les auteurs anglais n'ont plus trouvé *Cochlicella* avant Lulworth et Winfrith dans le Dorset ; à partir de là, l'espèce peuple toutes les côtes Sud-Ouest, Ouest et Nord-Ouest de la Grande Bretagne.

A l'Est de Brighton, en 1920, l'espèce est signalée à Rottingdean (Toms, 1922) situé à trois kilomètres de Brighton ; en 1930 (Aubertin, Ellis et Robson, 1930), elle atteint Peacehaven, à cinq kilomètres à l'Est de Rottingdean. Enfin, en 1935, une station totalement isolée est trouvée à cinq kilomètres à l'Est de Dartford sur le territoire de Greenhithe (commune située sur la rive droite de l'estuaire de la Tamise), par Burchell et Huggins (Burchell *in litt.*). Cette station ne survécut pas et en 1951 on ne trouve que des coquilles vides (A. G. Davis *in litt.*) ; nous avons fait la même constatation en 1956, comme nous l'indiquerons dans l'un des paragraphes suivants.

De ces quelques indications, on déduit qu'en Angleterre, *Cochlicella acuta* fut autrefois présent sur toute la côte Sud-Est, qu'il s'en est retiré partiellement pour y revenir ensuite. Cette propagation se poursuit-elle encore actuellement ? En Septembre et Novembre 1956, nous avons parcouru la côte Sud-Est, de Brighton à Margate, pour rechercher les nouvelles stations de ce Mollusque.

STATIONS NOUVELLES DU SUSSEX (Fig. 2)

— ENVIRONS DE BRIGHTON (Stations 1 à 13)

Les observations sont faites vers l'Est à partir de Brighton. La station de Saddlescombe est examinée à nouveau (Fig. 2, n° 1–4) ; elle demeure isolée et prospère ; le Mollusque se trouve en abondance sur les bords de la route qui relie Brighton à Poynings en passant par Varncombe Barn et en laissant très légèrement à l'Est Saddlescombe ; il est visible sur une longueur d'un kilomètre, à part une interruption de cent mètres à hauteur de Varncombe Barn (entre les stations 3 et 4). A l'Est de Brighton, *Cochlicella* se retrouve à Rottingdean (stations 5 à 8), à Saltdean (9 à 11) et à Peacehaven (12–13), tant sur la falaise en bordure de mer que le long de la route et légèrement au Nord de celle-ci. Entre Peacehaven et Newhaven, nous n'avons pas trouvé *Cochlicella*.

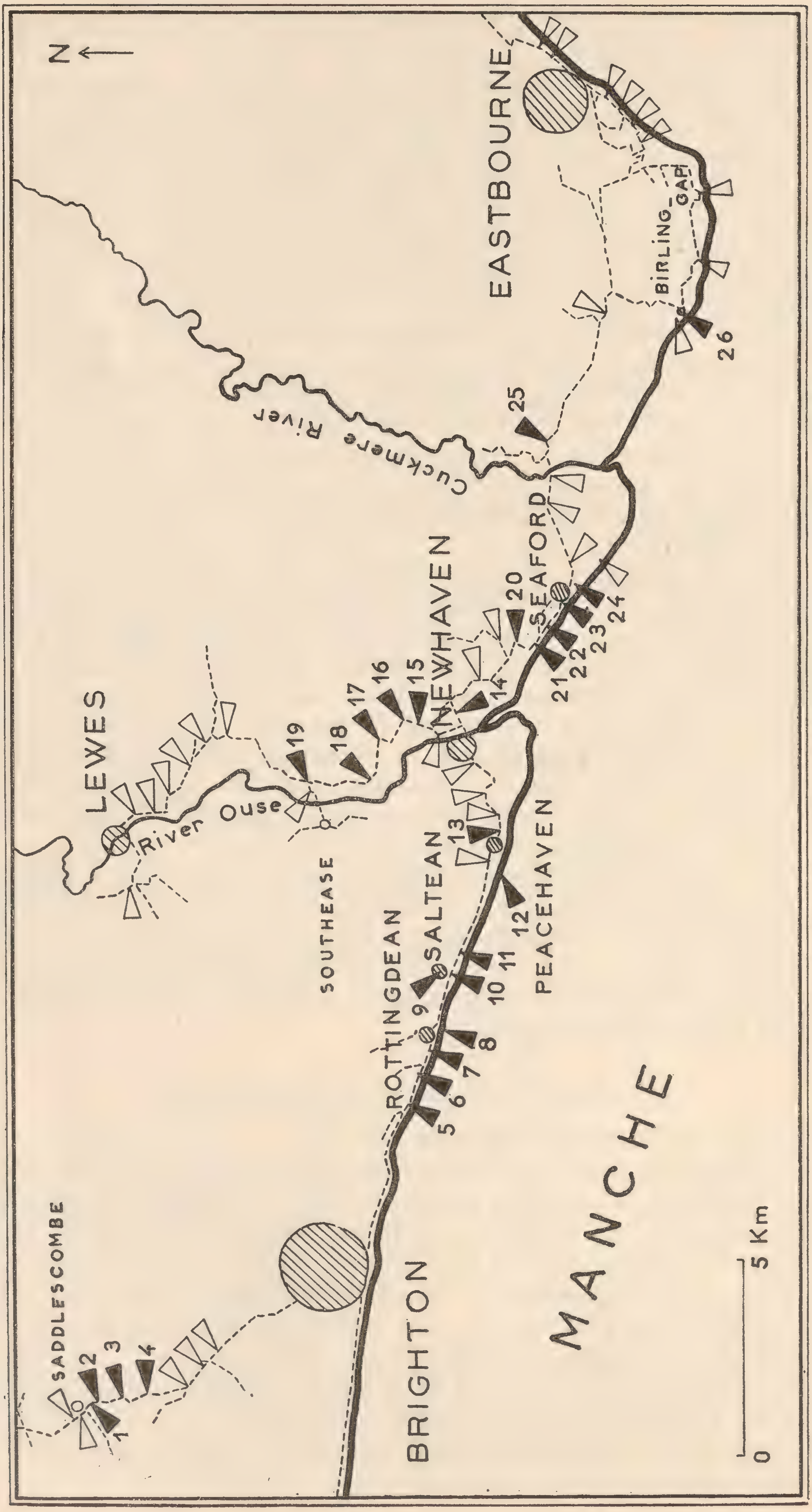

FIG. 2.—Carte du Sussex (Se reporter à la Fig. 1 pour le mode de représentation des stations).

— VALLÉE DE L'OUSE (Stations 14 à 19)

En 1930, Aubertin, Ellis et Robson admettaient comme possible la propagation de *Cochlicella acuta* le long de la vallée de l'Ouse. En 1956, le Mollusque s'étend dans cette vallée jusqu'à six kilomètres de la mer sur la rive gauche de l'Ouse, entre Newhaven et le pont de Southease (14 à 19). C'est aux approches d'une cimenterie que se localise la dernière station (19) sur les bords calcaires de la route B.2109. *Cochlicella* n'a pas été retrouvé entre cette station et Lewes.

— DE NEWHAVEN À EASTBOURNE (Stations 20 à 26)

A Seaford, *Cochlicella* abonde soit à 500 mètres de la mer (20), soit en bordure de mer sur la falaise calcaire (21 à 23) ou dans les terrains herbeux de la baie (24). L'espèce manque entre Seaford et la Cuckmere River, mais on la retrouve sur la rive gauche de ce fleuve côtier (25) le long d'un talus calcaire et d'un mur en ciment.

La dernière station vers l'Est (26) est située au sommet d'une falaise gazonnante, en bordure immédiate de la mer et à 50 mètres d'altitude, au lieu dit Birling Gap (Fig. 2 et 3). On y trouve les *Cochlicella* face à la mer en lisière de la clôture de l'hôtel sur une longueur de 20 mètres, puis dans l'enclos de l'hôtel et enfin entre celui-ci et le café situé à l'Ouest sur une profondeur de 10 mètres. La population est inférieure à un millier d'individus. Dans les prés ou les jardins des maisons voisines on ne trouve qu' *Helicella maritima* (Drap.), espèce souvent rencontrée avec *Cochlicella acuta.*

Cochlicella manque de Birling Gap à Eastbourne.

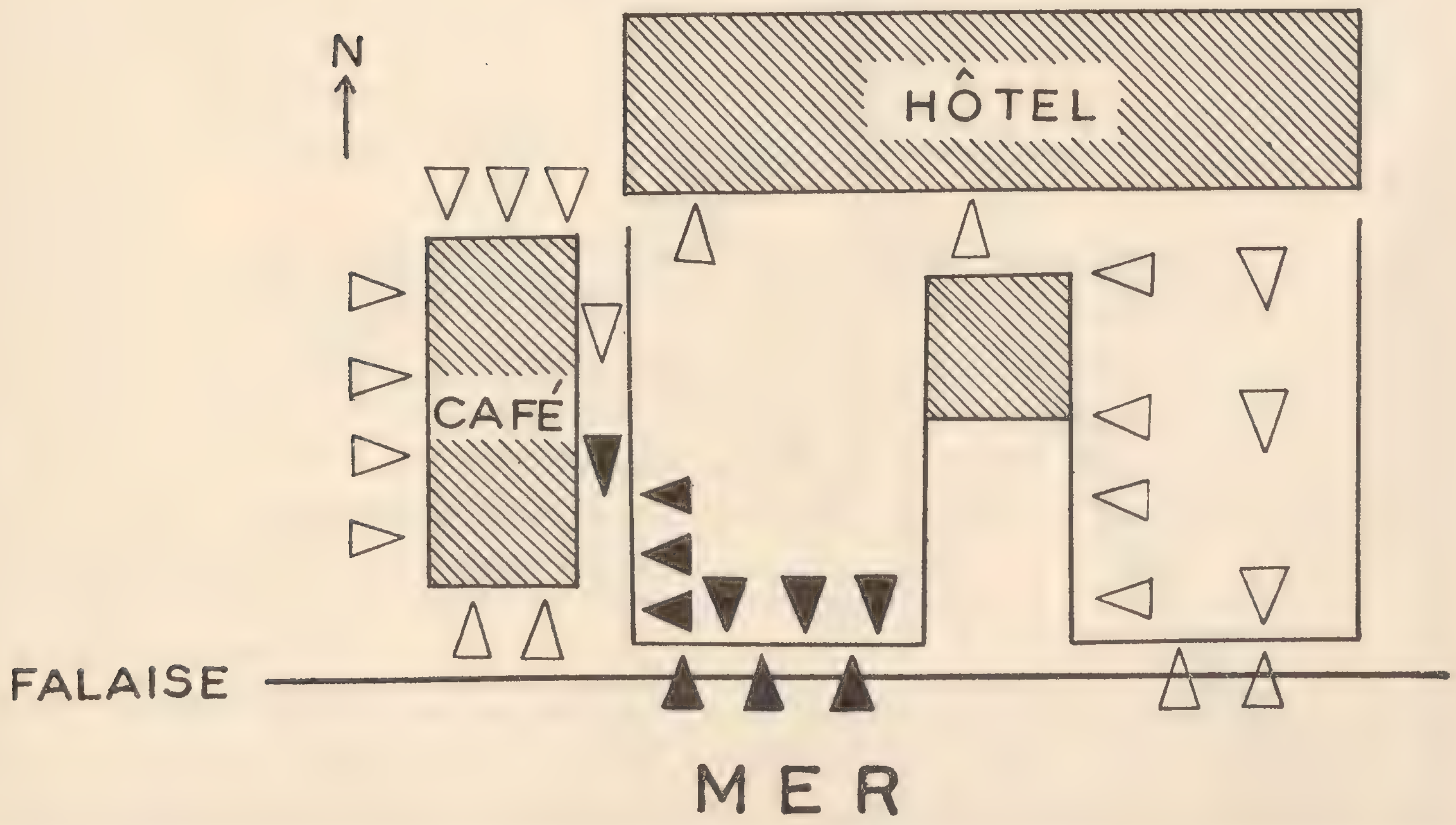

FIG. 3.—Schéma de la station de Birling Gap (Se reporter à la Fig. 1 pour le mode de représentation des stations).

STATIONS NOUVELLES DU KENT (Fig. 1)

La côte est suivie d'Eastbourne à Margate. Les falaises d'Eastbourne, Hastings, Folkestone, Dover, St. Margaret's Bay, Ramsgate et Margate sont examinées en vain ; il en est de même des terrains sablonneux en bordure de la " River Rother " près de Rye, ainsi que des dunes ou basses terres situées entre Eastbourne et Bexhill puis entre Rye et Sandgate. Une seule station nouvelle est découverte dans l'East Kent à Richborough. L'ancienne station de Greenhithe a été examinée à nouveau.

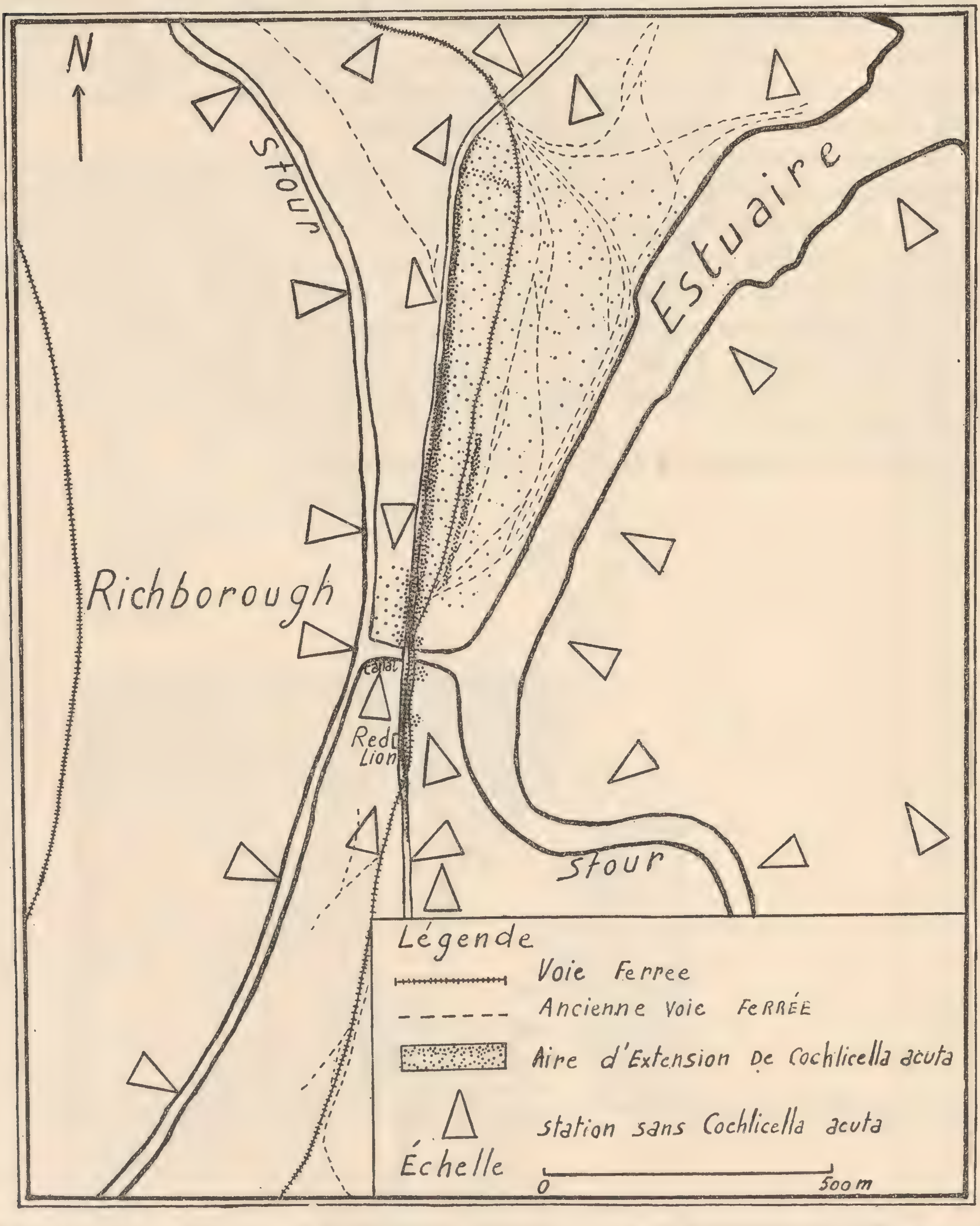

FIG. 4.—Carte du hameau de Richborough (Commune de Sandwich). (Se reporter à la Fig. 1 pour le mode de représentation des stations).

— RICHBOROUGH (Fig. 1 et 4)

Richborough, hameau de la commune de Sandwich, se trouve à trois kilomètres au Nord de la cité. Ce hameau est localisé entre les deux extrêmités d'une vaste boucle du fleuve côtier, la Stour, boucle qui atteint la cité même de Sandwich. Richborough est traversé selon l'axe nord-sud par la route A.256 qui relie Sandwich à Margate ; cette route franchit par un petit pont l'étroit canal qui unit les deux extrêmités de la boucle de la Stour au Nord de l'auberge " Red Lion " (Fig. 4). Les terres de Richborough sont plates et basses, c'est l'aspect typique d'un estuaire.

En Septembre 1956, *Cochlicella acuta* s'étend entre les deux extrêmités de la boucle du fleuve, principalement au voisinage de la route comme le montrent les ponctuations de la Fig. 4 (La densité des points correspond à la densité de population).

Le long de la route elle-même, l'espèce s'étend jusqu'à 480 mètres au Nord du pont et 320 mètres au Sud.

A l'Est de la route, il y a un vaste terrain portuaire, sillonné autrefois de voies ferrées mais devenu terrain vague ; *Cochlicella* abonde le long du mur en ciment qui sépare la route de ce terrain (pH 7) ; il s'étend ainsi jusqu'à 900 mètres au nord du pont. Sur le reste du terrain portuaire, la densité du Mollusque est faible (terrain de pH 6, 7) sauf le long d'un remblai riche en scories (pH 8,2) ou il abonde. Sur la bordure du quai, le long du fleuve, *Cochlicella* manque. Entre la rive droite de l'embouchure du fleuve et le rivage de la mer situé à 2 kilomètres vers l'Est, *Cochlicella* a été longuemment recherché en vain dans les basses terres incultes ou les dunes.

A l'Ouest de la route, vers l'extrêmité amont de la boucle du fleuve, on retrouve *Cochlicella* aux abords nord du pont, dans les terrains de l'usine Astra Fire Works. Au Nord de l'usine, ainsi que sur la rive droite de la Stour en amont de la boucle, il n'a pas été trouvé de *Cochlicella.*

La station est donc très nettement délimitée : elle s'étend sur une longueur maximum de 1.250 mètres en direction Nord-Sud sans quitter l'espace situé entre les deux parties de la Stour (la largeur maxima de la station ne dépasse pas 400 mètres). Elle comporte cependant une population importante que l'on estime, en Septembre 1956, à 50.000 individus.

En Novembre 1956, *Cochlicella* est toujours abondant le long de la route, mais il est rare sur le terrain portuaire. De nombreux troupeaux de boeufs, en attente d'embarquement, sont régulièrement parqués dans ce terrain vague depuis Septembre 1956. Le sol n'est plus qu'un mélange de bouse et de paille ; le long du mur en ciment, quelques *Cochlicella* ont échappé au massacre lorsque des arbustes épineux ont rendu impossible le piétinement du sol par le bétail.

— GREENHITHE (Fig. 1)

Les indications fournies par Davis (*in litt.*) nous ont permis de retrouver très facilement cette station. Elle est située à deux kilomètres au Sud de l'église de Greenhithe sur la route de Bean. Nous avons retrouvé des coquilles vides, plus ou moins décolorées, dans les touffes herbacées d'un talus, au carrefour de cette route et d'un chemin conduisant à la route

B.2174. Il n'y avait aucun *Cochlicella* vivant ; il s'agit donc d'une station dont la vie fut de courte durée.

INTERPRETATION

Depuis 1930, dans le Sussex, *Cochlicella acuta* a gagné 13 kilomètres vers l'Est, de Peacehaven à Birling Gap. La Station de Birling Gap très limitée en étendue et en population est probablement récente. Dans le Kent, l'espèce vit actuellement en une station isolée à Richborough (100 Km. à l'Est de Birling Gap).

Les colonies isolées de Birling Gap et de Richborough ainsi que l'ancienne colonie de Greenhithe proviennent probablement d'apports accidentels passifs. Ceci s'accorde avec l'interprétation donnée par Aubertin, Ellis et Robson (1930) qui constatent que les nouvelles stations apparaissent surtout le long des routes. L'observation faite par Rice (1930) d'un transport accidentel de *Cochlicella* sur le châssis d'une automobile entre Peacehaven et Pulborough (distance de 50 Km.) est une preuve de propagation accidentelle passive.

Les deux stations de Richborough et de Greenhithe nous montrent comment, dans l'extension du Mollusque vers l'Est, des colonies ont apparu, puis prospéré ou disparu.

A Richborough, la colonie n'est peut être pas très récente ; elle pût facilement apparaître au cours de la guerre 1914–1918, en une période d'importants trafics ferroviaires locaux. En outre, ce Mollusque rencontrait là un ensemble de circonstances favorables à son installation : estuaire et basses terres protégés du Nord par les falaises du Thanet, sol riche en calcaire (remblai de voies ferrées, fondations d'un mur en ciment). L'espèce est maintenant bien installée, mais il a suffi, pendant quelques mois, d'un parquage intensif de bétail pour réduire cette population qui ne demeure abondante que le long de la route.

A Greenhithe, l'introduction du Mollusque dans une petite vallée humide à deux kilomètres de l'estuaire de la Tamise se présente différemment : l'humidité et le calcaire semblent satisfaisants, mais la région, plus distante de la mer, subit moins que Richborough l'influence maritime, elle est donc plus sujette aux " pointes " de froid en hiver. Dans le *Climatological Atlas of the British Isles* (1952), pl. 14, la carte " Absolute minimum temperature 1901–1940 " donne pour la région de Sandwich + 15° F., et pour la région de Greenhithe + 5° F. ; il n'est donc pas étonnant que l'espèce n'y ait pas survécu.

L'extension de *Cochlicella acuta* n'est donc vraisemblablement qu'un phénomène passif, s'effectuant par voie accidentelle, à Saddlescombe, Birling Gap, Richborough, Greenhithe. Mais la propagation lente de l'espèce vers l'Ouse et Seaford semble bien active. Dans ce cas, on peut affirmer qu'elle est très lente aux limites nordiques de l'espèce. Ceci apparaît plus nettement encore sur les côtes du continent que sur les côtes anglaises ; ainsi *Cochlicella* était déjà présent sur le littoral ouest de la Belgique à la Panne en 1910 (Bouly de Lesdain, 1911) ; or, en 1956, ce Mollusque n'a pas encore dépassé Oostduinkerque, à 8 kilomètres à l'Ouest de La Panne.

Quelle est la cause de l'extension de cette espèce vers le Nord-Est, avec passage des côtes de la Manche à celles de la Mer du Nord ? On ne peut invoquer une explication écologique ou alimentaire, mais la cause la plus vraisemblable est celle du réchauffement actuel de la Mer du Nord par suite du recul glaciaire en Scandinavie. En effet, si l'on compare les deux périodes 1903–1927 et 1928–1951, on constate que la température moyenne des eaux marines du Pas-de-Calais s'est élevée de 0,6° C. (Lumby, 1955), ce qui entraîne évidemment un réchauffement des côtes.

Durant la période Saxonne, *Cochlicella acuta* était dans l'East Kent (Castell, 1949). Au début du Quaternaire, il se trouvait également en France près de la frontière belge (un exemplaire ramassé dans les dunes pleistocènes de Ghyvelde, Bouly De Lesdain, 1912) ; l'espèce disparut ensuite et ce n'est qu'au début de ce siècle qu'elle fut retrouvée vivante dans la même région, à Dunkerque puis à La Panne (Bouly De Lesdain, 1905, 1911 ; Labeau, 1905). En conséquence, il semble prouvé que, des deux côtés du Détroit du Pas-de-Calais, ce Mollusque était installé aux cours de périodes antérieures plus chaudes du Quaternaire, qu'il disparut ensuite et qu'enfin actuellement la propagation se poursuit à nouveau à la fois le long de la côte anglaise du Sud-Est et des côtes françaises et belge du Nord-Est.

III. — LONGÉVITÉ DE L'ESPÈCE

Aubertin, Ellis et Robson (1930) ont étudié la croissance de *Cochlicella acuta.* S'appuyant sur des observations faites en élevage, les auteurs anglais se sont demandés si les individus atteignant ou dépassant 15 mm. de longueur ne seraient pas nés l'année précédente ? En conséquence, puisque la moyenne des tailles obtenues dans leurs colonies est de 15 mm. ces auteurs ont estimé qu'en dépit d'une forte mortalité hivernale la durée de vie de l'espèce est de deux années. Les courbes de croissance bimodales et parfois trimodales obtenues par Robson semblaient confirmer cette hypothèse. En tenant compte des méthodes actuelles de la Biométrie, nous étudierons à nouveau la croissance de *Cochlicella acuta* ; les prélévements sont effectués en Angleterre, Nord de la France, Péninsule Ibérique, littoral méditerranéen, à diverses époques de l'année. Dans la présente étude, nous nous limiterons à l'examen de deux stations anglaises : Richborough avec un prélèvement de 1.064 individus le 5 Septembre 1956 et Saddlescombe avec un prélèvement de 605 individus, le 7 Septembre 1956.

— TECHNIQUE

Dans une aire réduite, choisie pour la forte densité de sa population, la totalité des individus vivants sur les plantes ou sur le sol est cueillie afin que l'échantillon corresponde le mieux possible à la population réelle de la station examinée ; tous les individus morts sont éliminés.

Les mesures sont prises sur la plus grande longueur de l'individu, entre le sommet de la coquille et le bord distal du péristome. Les individus sont mesurés au microscope à l'aide de l'oculaire micrométrique ou du vernier de la platine mobile selon les longueurs. La précision des mesures varie entre 2/10 et 1/15 de mm.

— ETUDE DES HISTOGRAMMES

Les coquilles sont mesurées en 1/10 de mm. Ces mesures sont réparties en classes dont l'étendue est de 1 mm. La distribution des fréquences dans chaque classe est représentée sous forme d'histogrammes (Fig. 5 et 6). En abscisses sont portées les longueurs de la coquille en 1/10 de mm. ; en ordonnées sont portées les fréquences en pourcentage, ce qui rend les graphiques facilement comparables entre eux.

On constate d'abord que les distributions de fréquence sont nettement unimodales, ce qui est un argument en faveur d'une croissance en une seule année. La preuve en est faite par l'étude des prélèvements effectués en France en 1956 et en 1957 à diverses périodes de l'année, ce qui fera l'objet d'une publication ultérieure. Il peut arriver cependant que des individus de l'année précédente soient encore vivants au printemps, mais ils sont rares, alors que les coquilles mortes de l'année précédente jonchent le sol des stations riches en *Cochlicella.*

On constate ensuite que les animaux les plus grands ne mesurent pas la même longueur dans les deux stations anglaises, bien que les prélèvements n'aient eu lieu qu'à deux jours d'intervalle. Pour l'échantillon de Richborough, la classe modale a pour limites 150,5 et 160,5 dixièmes de mm. alors que pour celui de Saddlescombe ces limites se trouvent entre

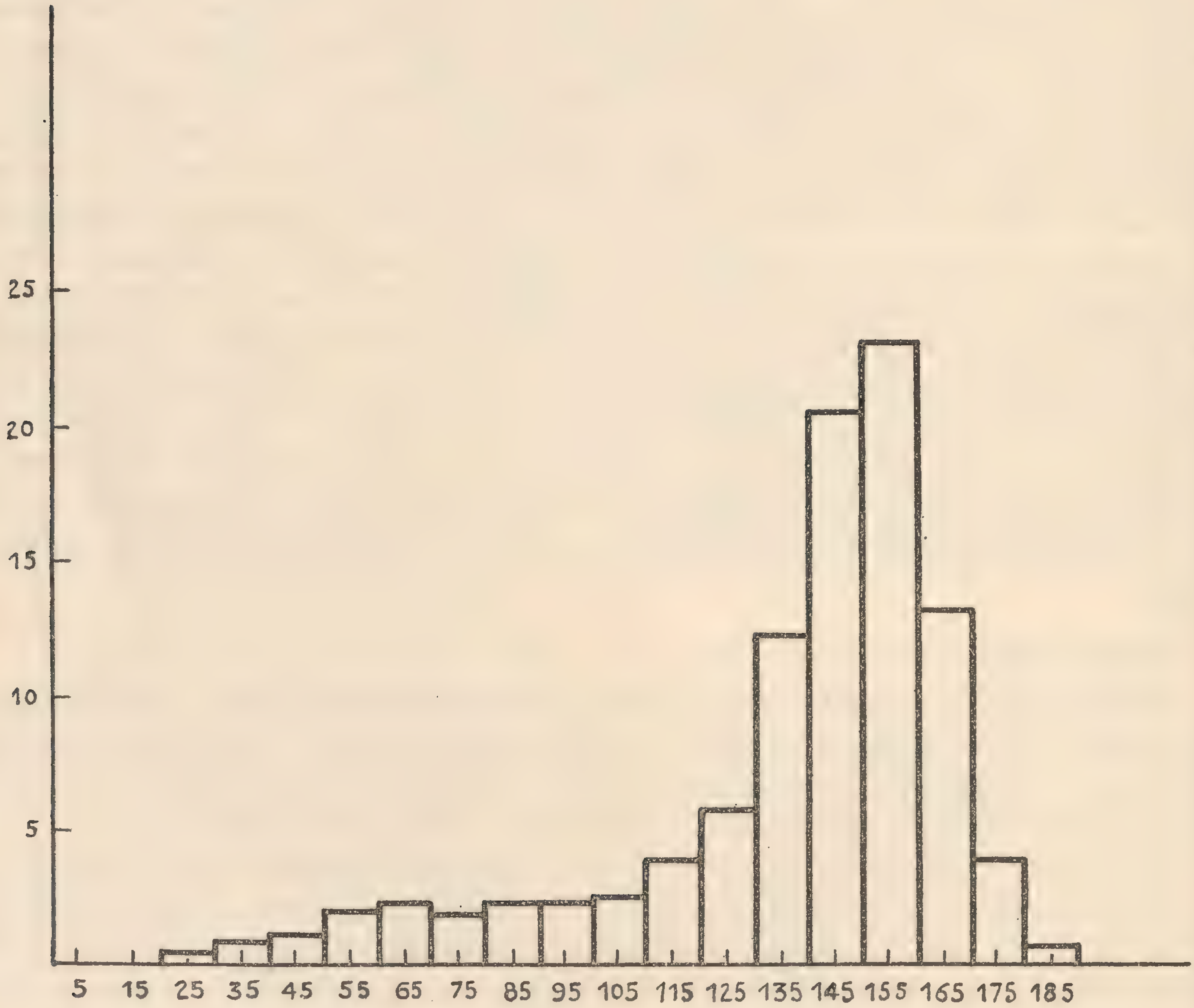

FIG. 5.—Histogramme du prélèvement de Richborough (1.064 individus).

160,5 et 170,5. Des observations semblables ont été faites en France dans le Boulonnais en comparant un prélèvement d'Etaples (11 Août 1956) avec une classe modale de 140,5 à 150,5 et un prélèvement d'Ambleteuse (29 Août 1956) avec une classe modale de 110,5 à 120,5. On est, peut-être, en présence de différences génétiques entre les diverses populations, ou plus simplement en face de différences liées au milieu écologique (température, nourriture, etc....).

Rode (1934) pense que les stations les plus éloignées de leur habitat normal (c'est à dire à l'intérieur des terres ou aux limites d'extension) seraient constituées par des formes géantes. Les observations de Richborough en Angleterre, d'Ambleteuse en France s'opposent à cette opinion. Il semble qu'il y ait souvent des formes de dimensions diverses dans des habitats assez voisins (Ambleteuse et Etaples en France, par exemple). Il n'est donc pas possible actuellement de conclure sur ce point.

La seule conclusion évidente de l'examen des histogrammes est celle-ci : la longévité normale de *Cochlicella acuta*, au voisinage de la limite nordique d'extension de l'espèce, ne dépasse pas une année.

SUMMARY

The Mediterranean land-snail, *Cochlicella acuta* (Müller), whose extent in Great Britain had been examined by Aubertin, Ellis and Robson in

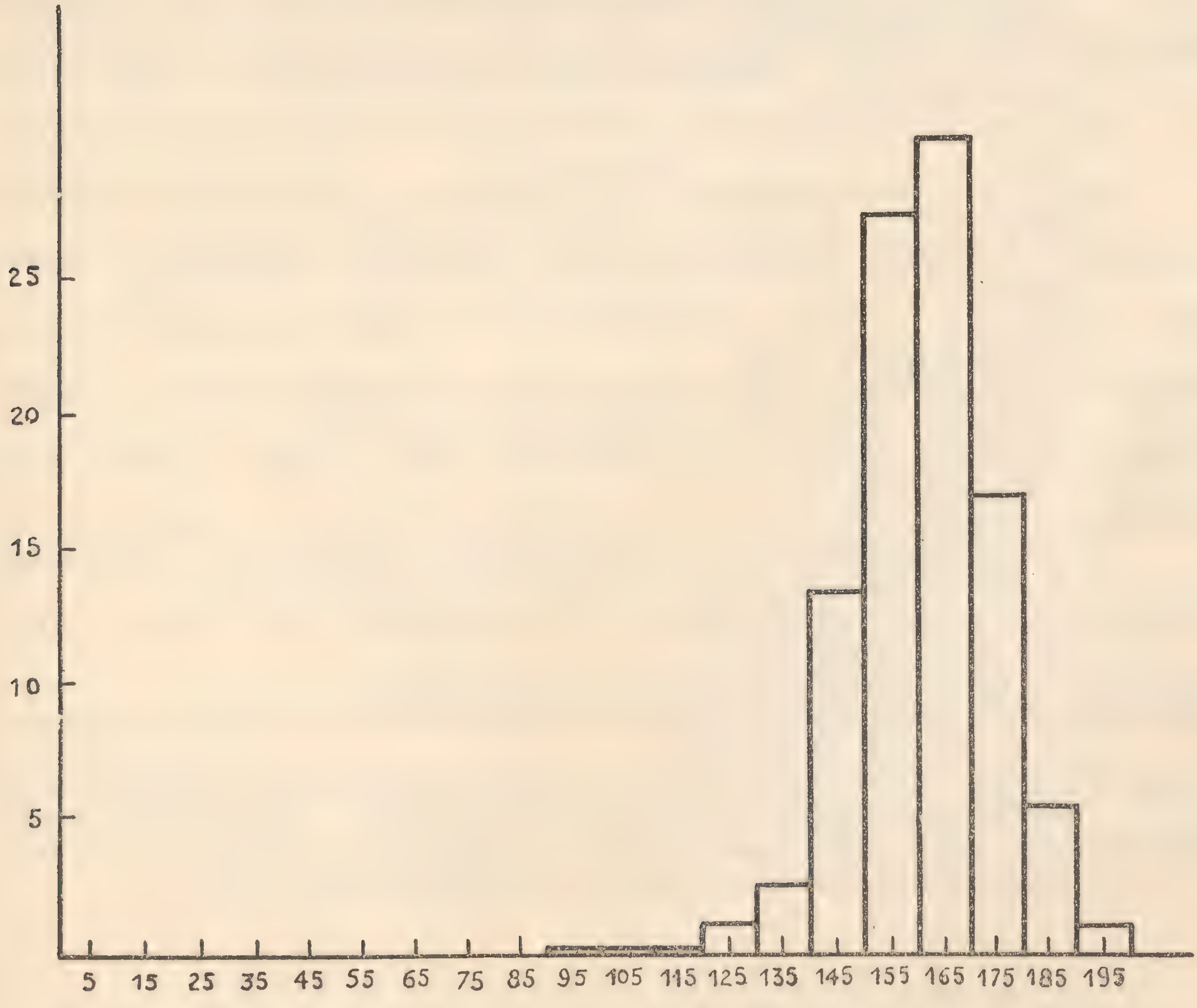

FIG. 6.—Histogramme du prélèvement de Saddlescombe (605 individus).

1930, has recently spread into Sussex to the east of Brighton, between Peacehaven and Birling Gap, and has invaded the Ouse valley. Two new stations, entirely cut off from the Sussex populations, have been discovered in East Kent: one at Greenhithe which only existed for a short period, the other at Richborough (borough of Sandwich) which is quite stable and probably dates back to the time of the 1914–1918 war. It is doubtless the present slow rise of the temperature of the North Sea which facilitates the propagation of this Mollusc towards the east.

The collection of two large groups of specimens in Richborough and in Saddlescombe near Brighton has made possible the study of the growth of *Cochlicella*. A comparison between the histograms of these collections and the histograms based on the collections carried out in the North of France renders possible the following affirmations: the development of *Cochlicella acuta* requires one year since the curves obtained show only one maximum; the size of the large specimens varies from one station to another without apparent cause.

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LIEUTENANT HANKEY AND *CYPRAEA* GROWTH

By Lieut. Col. R. J. Griffiths

(*Read before the Society*, 13 *April* 1957)

A MATTER of discussion among conchologists of the last century was the suggestion that *Cypraea* could increase its size after inflection of the shell and formation of the characteristic serrations on the base. Reeve (1845) appears to have believed that continued growth was possible, and quotes a letter from Lieut. J. B. Hankey, R.N., which described the method of dissolution of the old shell, by cracking and breaking after the action of a solvent, and the rapid growth of the new shell. This story has been repeated by Ray (1951) and, with some reservations, by Allan (1956).

The possibility that the statement was based on mistaken observation must, however, be considered, and there are indeed several reasons for doubt. To my knowledge no naturalist since Lieut. Hankey has reported seeing this act of shell renewal; since it was originally seen " in more than one instance " it is surprising that it seems to have escaped the notice of subsequent observers. Secondly, no specimen of a shell either in the dissolving stage or in the stage of regrowth appears to have found its way into any collection. Lastly, the method of growth is not usual for Mollusca, and, in view of the danger from predators when the shell of the animal is dissolved, it would be surprising if such a wasteful and inefficient means of shell development had been evolved.

Until further evidence comes to hand, it appears wiser to assume that Lieut. Hankey was mistaken in his observations.

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REVIEWS

The Cracherode Shell Collection. Guy L. Wilkins. Pp. 62, 6 half-tone plates (15 figures). Bulletin of the British Museum (Natural History), Historical Series, Vol. 1, No. 4. London, March 1957. *21s.*

This book is the third and last of a series describing important collections of molluscan shells acquired by the British Museum in the eighteenth and early nineteenth centuries.

Clayton Mordaunt Cracherode was a wealthy, leisured Englishman who amassed a huge collection which included rare books and prints, and coins, as well as minerals and other natural curiosities. Among these was a series of nearly a thousand shells of about 800 species. Cracherode was for some years a Trustee of the British Museum, and when he died in 1799 the whole of his valuable collections passed to that body.

In his delightful account, Mr. Wilkins traces the history of the Cracherode shell collection and the doings of those who catalogued and studied it. In the course of his researches he has ascertained that George Perry, whose *Conchology* was so much despised by his learned contemporaries, figured several Cracherode specimens. In addition, he has discovered a number of hitherto unrecognized types of species described by W. E. Leach and J. E. Gray, and of specimens figured by J. G. Children in *Lamarck's Genera of Shells* and by W. Wood in *Index Testaceologicus.*

There is scholarly comment on the new finds and many diverting anecdotes of the earlier workers on shells and their relations with each other. In addition, there is an interesting short biography of Cracherode himself. The whole is a most attractive blend of the erudite and the entertaining, which is unusual in modern scientific literature.

Dennis Curry.

The Scallop. Ian Cox (Editor). Pp. 135. London: The "Shell" Transport and Trading Company, Limited. 18 October 1957. 14*s.* 3*d.* (including postage).

This artistically designed and lavishly illustrated volume, issued to mark the diamond jubilee of the Shell Company, was produced primarily for the shareholders and for purchase by staff of Shell Companies all over the world, though a limited number of copies is also available for sale to the public on written application to The Shell Petroleum Company, 1 Kingsway, London, W.C. 2.

Every aspect of the Scallop is treated in a scholarly and entertaining manner by selected writers in these "studies of a shell and its influences on mankind". A foreword by the Chairman, Lord Godber, explains how the scallop shell came to be adopted as the Company's trademark, while Professor B. Woledge traces the etymology of the name. The section of most direct interest to students of Mollusca, "The Living Scallop," is by Dr. W. J. Rees, with beautiful colour photographs by Dr. D. P. Wilson and drawings by the late G. L. Wilkins. Sir Mortimer Wheeler deals with the Scallop as a symbol in ancient times, Christopher Hohler with its ecclesiastical rôle, and Sir George Bellew with its heraldic significance. An account of the shell's place in art is given by James Laver for Europe and by Adrian Digby for ancient America, while the gourmet will take delight in the final section by Paul Gaultier.

So exquisite a book evokes gratitude to the Company for devising so felicitous a commemoration of their sixtieth year.

Kopffüsser (Tintenfische). SIEGFRIED H. JAECKEL. Die Neue Brehm-Bücherei, Heft 190. A. Ziemsen Verlag, Wittenberg. Pp. 81, 54 text-figures. 1957. 4·50 DM.

IN this introductory handbook to the Cephalopoda, Professor Jaeckel has written a more detailed account of this class than is usually found in text-books of invertebrate zoology. It will therefore be valuable to the student who wishes to get a clear idea of the range of form within the group, and enable him also to learn something of its natural history and zoogeography.

The first half of the book describes the morphology and anatomy of octopuses and squids, and includes, among others, accounts of chromatophores, light organs, the cephalopod shell, the nervous system and hectocotylization. In the chapter on natural history, concerned mainly with movement, migrations, food, predators, reproduction and development, much recent work has not been included. Other chapters are devoted to distribution, cephalopods of the German coast, a synopsis of classification and a key to species found in the southern North Sea. The text is adequately illustrated with line drawings, mostly adapted from other works; some, such as the figures of the eggs of *Loligo*, are of poor quality. Despite some omissions, this compilation is a useful first guide to the Cephalopoda.

W. J. REES.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND

757th Meeting, held at the British Museum (Natural History), 19 October 1957

Mr. A. E. Ellis, vice-president, in the chair.

Member Deceased

The Chairman reported the death, on 15 September, of Mrs. Alison Mary Winckworth.

Members Elected

Captain Michael David King, R.E., c/o Lloyd's Bank, Ltd., 6 Pall Mall, London, S.W. 1.

Anthony Edward Shuttleworth, 1 Harbledown Road, Fulham, London, S.W. 6.

Communications

" On an unfigured species of *Plekocheilus* (*Eurytus*) from Colombia," by T. E. Crowley and T. Pain.

" On the occurrence of *Margaritifera auricularia* (Spengler) in the English Pleistocene," and " *Monacha cantiana* (Montagu) in Pembrokeshire," by M. P. Kerney.

" Note on *Petricola pholadiformis* Lamarck," by E. St. John Burton.

" *Pisidium conventus* in Loch Lomond," by W. Russell Hunter and H. D. Slack.

" *Pisidium* from Hirta, St. Kilda," by W. Russell Hunter and J. D. Hamilton.

" Extension du Gastropode méditerraneen, *Cochlicella acuta* (Müller), dans le sud-est de la Grande Bretagne," by M. de Leersnyder and H. Hoestlandt.

" Note on Dixon & Watson's *Descriptive Manual of British Land and Fresh-water Shells*," by J. W. Jackson.

Exhibits

Special exhibits : Thiaridae and *Ficus.*

Mr. G. A. S. Barnacle : *Paludomus* from Ceylon.

Rev. H. E. J. Biggs : *Anodonta cygnea* from a fishpond, South Darenth, Kent.

Mr. S. P. Dance : Thiaridae and *Ficus* from the British Museum collections.

Mr. A. E. Ellis : *Melanoides tuberculata* (Müller) from tank in greenhouse 15, Royal Botanic Gardens, Kew, collected by J. W. Poulton, July 1957 (living specimens were also exhibited by Mr. Dance).

Lt. Col. R. J. Griffiths : shells from Pitcairn Island.

Mr. M. P. Kerney : *Lauria anglica* (living) from St. Ishmaels, Pembrokeshire, and specimens to illustrate his communications.

Mr. B. S. Kisch : stomach contents of *Astropecten*, including many kinds of shells.

Dr. L. Lloyd-Evans : *Acanthinula lamellata* from Pembrokeshire.

Mr. T. Pain : Thiaridae from British Guiana and Surinam.

Mr. G. W. Pitchford : photographs of eggs and embryo of *Sepia.*

Mr. L. W. Stratton : land shells from Mickleham, Surrey.

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LAND MOLLUSCA OF NORTH AMERICA

(North of Mexico)

By

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Curator of Mollusks, Academy of Natural Sciences of Philadelphia.

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CONTENTS.

PAGE
Officers and Council for 1958–59 269
Littoral collecting in the Persian Gulf—H. E. J. BIGGS . . 270
On a new sub-species of *Placostylus fibratus* (Martyn) from New Caledonia—T. PAIN 276
A note on *Helicodonta obvoluta* (Müller)—S. P. DANCE . . 278
Haliotis speciosa, a South African species—R. R. TALMADGE . 278
Viviparus eaten by crows—T. E. CROWLEY 280
Drought resistance in an African freshwater Bivalve—S. P. DANCE 281
A short history of the known occurrences of *Helicella gigaxi* (L. Pfeiffer) in Ireland—A. W. STELFOX 283
The A. W. Stelfox collection of non-marine Mollusca—N. F. McMILLAN 285
The validity of the name *Eulima candida* Marrat—N. F. McMILLAN 286
Vitrina major (Férussac) in Surrey: a correction—H. E. QUICK 286
Clausilia bidentata (Ström) with double aperture—H. SCHLESCH 287
Cochlicella acuta (Müller): another colony in Sussex—F. H. COZENS 287
Reviews 288
Molluscan mortality at Youghal, Co. Cork—L. S. ATKINS . 290
Proceedings: 16 Nov., 14 Dec. 1957; 18 Jan., 15 Feb. (Annual Meeting), 15 March, 19 April, 17 May 1958 . . . 291
Accounts for 1957 297
PLATE 8

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LITTORAL COLLECTING IN THE PERSIAN GULF

By Rev. H. E. J. Biggs, F.L.S.

(*Read before the Society*, 15 *March* 1958)

Having in mind the extensive work of Capt. F. W. Townsend in this area and the number of papers on this collecting by J. C. Melvill, one hesitates to write anything on such a subject as collecting in the Persian Gulf. The Mollusca recorded in this paper were taken many years ago and set aside in favour of work on the non-marine Mollusca of the area. However some time ago I took in hand the work of naming those which had stood in my collection without names and also of reviewing those named by Mr. J. R. le B. Tomlin, who had seen my specimens. To my surprise I found that there were quite a number unrecorded in any of Melvill's or Standen's lists. This may be due to the fact that Townsend's collecting was mostly by dredging, mine entirely by shore collecting. Again I found that one at least, a *Siphonaria*, was apparently undescribed. Also, perhaps, one of the *Arca* taken is new. These two facts seemed to give some justification for the following notes and list of species.

Most of my collecting in the Gulf was hurriedly undertaken when the ship on which I was travelling called at some port. In October 1922 the boat stopped for some time at Muscat and Bahrein, giving an opportunity for collecting. My stays at Bundar Abbas were longer, hence the larger number of shells taken there. On one of these occasions I was offered a trip across to Hormuz Island on one of the dhows bringing stone from the mines there. We crossed in the afternoon of 11 May. On arrival I found the tide going out, so started to collect near the ruined Portuguese fort and on the west of the bay, and there took a few fine examples of *Chiton haddoni* Winckworth. I spent the night with the manager of the Red Oxide mines.

For the following day, 12 May, my journal records " Up before sunrise and after a scanty meal set off before 5 a.m. to walk round the bay eastwards, aiming at some rocks which seemed to go right down to the sea. The tide was out and I reached the rocks but they were far from the water's edge at low tide. The tide turned at 8.15 a.m. and I returned, reaching home at 9.15 a.m. with a fairly satisfactory catch ". For a great part of that day I collected along the shore where *Murex anguliferus* Lamarck abounded as did *Arca* (*Barbatia*) *nivea* Chemnitz. Some species of *Trochus* and a *Turbo* were also in great numbers. My journal also records that I took two very beautiful Nudibranchs, but both decomposed before I could get them to a place where I could preserve them. The evening was devoted to collecting.

May I continue to quote my journal. " Left Hormuz Id at 10.45 p.m., the moon just rising over the bay, which was almost as glass. The dhows lay in the bay outlined against the brightening sky and the old Portuguese fort seemed miles away. I was carried on a man's shoulders to a small boat and then we all rowed to the dhow. With the rising moon there came a breeze and the sail was at once hoisted and we began to move slowly.

Out in the bay the breeze stiffened and we were soon going well. I expected to be in Bundar Abbas very soon but not many miles out we stopped. I spread out my valise and tried to sleep. . . ." When I woke up we were just off the port, but I shall never forget the weight of my blanket, it was drenched with dew.

Another wonderful experience was collecting on the shore at Sabzabad near Bushire. In the month of June with the temperature well up in the 80's F. it is a never-to-be-forgotten experience to strip and work a deep rock pool for Mollusca. My regret was that my time here was so limited.

The following list is of the Mollusca which have so far been determined. My great debt is to Mr. J. R. le B. Tomlin, who named the majority, but I must also thank Mr. A. E. Salisbury, Mr. G. L. Wilkins, Dr. Harald Rehder, Lt. Col. R. J. Griffiths and Mr. W. L. Woodward. Without their help this paper would never have appeared. The taxonomic order is that of Theile (1931, 1935). In view of the work of Prof. Bashir E. Allouse, I have not thought it necessary to give a full bibliography, but just to mention the papers immediately concerned with these notes.

LORICATA

Chiton lamyi Dupuis : Bushire, 6.v.1935. Two adults and one juvenile.

Chiton (*Acanthopleura*) *haddoni* Winckworth : Hormuz Id. Four fine examples from rocks. They measure about 6·5 cm. as dried, but I did try to keep them stretched at full length when drying them.

GASTROPODA

Diodora funiculata (Reeve) : Hormuz Id., one living example.

Cellana aster Reeve : Hormuz Id., two living shells taken on a rock. Melvill and Standen give this species as *Helcioniscus novem-radiatus* Quoy & Gaimard for Bombay, but do not mention its occurrence in the Persian Gulf.

Euchelus asper (Gmelin) : In both papers (Melvill & Standen, 1901 and Melvill, 1928) this species is recorded only for Karachi. I took it there myself in 1935 and the three examples are larger than those from the Persian Gulf. On Hormuz Id. 18 examples were taken on 12.v.1933 ; they range from 20 to 22 mm. in height for the adults, whereas the Karachi specimens are from 24 to 28 mm. Those taken at Bushire by me on 7.vi.1935 (four examples) also conform in range of size to the Hormuz examples.

Cantharidus kotschyi (Philippi) : This species is apparently widespread in the Persian Gulf. Melvill (1928, 97) only records it for Sheikh Shuiab Id. It occurred to me plentifully on Hormuz Id. on rocks at low water on 12.v.1933, and 22 examples remain in my collection after many have been given away. It was collected at Bushire on rocks at low water, Bahrein Id., seven examples, 24.x.1922, and Bundar Abbas, on the old pier, five examples, 31.x.1931.

Monodonta dama (Philippi) : This species is not recorded by Melvill & Standen. I only obtained one example alive in Muscat Harbour, 27.x.1931. It may be a rare species in the Gulf.

Umbonium vestiarium L. : Bundar Abbas, 19.v.1933. Nineteen living examples taken. Dead shells in plenty adorn the beach here with their beautiful colours.

Turbo coronatus Gmelin: Common on the rocks on Hormuz Id. Melvill & Standen give the species for Karachi, but make no mention of the Gulf. In view of the numbers I took this seems strange. All examples now left in my collection are eroded except the youngest. I also took one juvenile example on a rock in Muscat Harbour, 27.x.1931.

Nerita albicilla L.: Bundar Abbas, 8 examples, May 1933; three examples (small) from the old pier, 3.x.1931. All these were living; Melvill & Standen record it only for Karachi.

Nerita maura Recluz: Hormuz Id. One dead shell found. Not mentioned by Melvill & Standen.

Littorina (*Melaraphe*) *scabra* L.: Bundar Abbas, 14.v.1933, 24 examples of normal coloration, but all but one are young specimens, some rather pale. There are two specimens devoid of markings and I cannot trace that this form is named, so it is herewith described:—

Var. **rhodea** (*var. nov.*): unicolorous, reddish-brown, no trace of markings, somewhat shining. Type and one paratype in my collection. All the examples referred to, including the new variety, taken from the crevices between stones of the sea wall.

Heliacus variegatus (Gmelin): Hormuz Id. 7 living examples on rocks.

Architectonica perspectiva (L.): Bundar Abbas, one dead, November 1931.

Planaxis sulcatus Born: Widely distributed in the Gulf. Hormuz Id., 62 examples of all ages taken from rocks. A fairly typical set and I have measured seven examples; these give the ratio for height/breadth as 1·54. Muscat, 27.x.1931, 8 examples collected. Bahrein Id., 24.x.1922, 8 examples taken alive on rocks. These are much more squat in form and give the ratio height/breadth 1·37. They may be a local race. Bundar Abbas pier, 31.x.1931, 7 examples. Bushire (Sabzabad), 7.vi.1935, one fine example taken.

Cerithidea (*Cerithideopsilla*) *cingulatus* (Gmelin): Bundar Abbas, November 1931, considerable numbers taken on the old pier set up by the South Persia Rifles during the first World War. This is east of the town. A few were also found in a pool in a river bed further east. This pool is behind a bar of sand and can only be reached by sea water during abnormal tides, and only broken from the other direction when flood waters come down from the land. The water was too dirty for me to test it for brackishness. By 1933 the old pier had been taken away, but I found the species in thousands on and around the remains of it. I took 63 examples and measured them. The largest shell was 26·1 mm. in height and the smallest 20·2 mm. The average ratio height/breadth was 2·47, the range of variation being from 2·80 to 2·20. This means that the species has not a wide variation in shape. On 12 May 1933 I took a few from a colony of several hundreds in a bay on Hormuz Id.

Cerithium petrosum Wood: On rocks, Hormuz Id., very common. There appears to be so much variation in this set that further study may reveal more than one species.

Cerithium scabridum Philippi (=*yerburyi* Smith): Same locality as the foregoing, but although in fair numbers with far less variety.

Cerithium clypeomorus Jousseaume : Three very young examples taken at Muscat on 27 October 1931.

Cerithium morus Lamarck : Bushire, 7.v.1935, 14 examples. Bahrein Id., 24.x.1922, 4 examples taken.

Turbonilla sp. : One example of an at present unidentified species from Hormuz Id., November 1931.

Amatharia tricarinata L. : Hormuz Id., one small and young example.

Natica (*Neverita*) *didyma* Röding : Bundar Abbas, November 1931, 8 dead shells.

Cypraea arabica L. : One dead shell, Muscat, 12.x.1922.

Cypraea turdus Lamarck : Bushire, 6.v.1935, two fine living shells, perhaps a little young but nevertheless fully grown.

Cypraea carneola L. : Bushire, one very young shell taken alive on 7.v.1935.

Bursa (*Lampusia*) *pilearis* Lamarck : Hormuz Id., two recently dead shells.

Murex anguliferus Lamarck : Quite a number taken alive on the sand near the rocks by the landing place on Hormuz Id.

Thais carinifera (Lamarck) : Hormuz Id., very common. Bundar Abbas, fairly common, 1.xi.1931 and May 1933. It is difficult to understand why this species is not recorded for the Gulf by Melvill & Standen. In their 1901 paper it appears as *Cuma carinifera* Lamarck from Karachi, and in Melvill (1928) it is noticed from Bombay, collected by Col. A. J. Peile.

Thais pseudohippocastaneum Dautzenberg : Muscat, 7 examples, 27.x.1931 ; Bundar Abbas, fairly common on the old pier November 1931 ; Sabzabad (near Bushire), 1 example, 7.vi.1935.

Thais tissoti Petit : Hormuz Is., 8 examples on rocks. Not recorded by Melvill & Standen.

I have been unable to track down the original descriptions of these two latter species or to find any material with which to compare them. They were determined by Mr. Tomlin.

Drupa tuberculata Blainville : A common shell on rocks at low water, Hormuz Id. Another unaccountable omission from the Melvill & Standen lists.

Drupa (*Morula*) *granulata* (Duclos) : Hormuz Id., 11 examples. These are rather small and may be a local race of this widely distributed species, which is found from the Red Sea to Australia. Not mentioned in the Melvill & Standen lists.

Drupa margariticola Broderip : Common on the rocks on Hormuz Id. ; I took a very long series. Four examples taken near Bushire, 7.v.1935, are of a slightly more solid form. Five of the Hormuz Id. set are lighter than the others in colour. Melvill & Standen (1901) state that the species is rare on the Makran coast, and there is no mention of it in Melvill's 1928 list. Again one of Mr. Tomlin's determinations and I have found no reason to doubt his accuracy.

Pyrene (*Mitrella*) *blanda* Sowerby : Bundar Abbas, November 1931 and

May 1933. This species crawls on the sand between tidemarks. At low tide I took 50 examples of the thousands crawling about. They show considerable variation in size and colour, ranging from 15·5 to 11·2 mm. in height. The wavy lines on the body whorl vary from fine and close to broad and few; 10 on the body whorl of one young shell and 26 on the most closely marked. I did not find any of the immaculate form (var. *candidans*) mentioned by Melvill & Standen (1901, 403).

Nassarius pullus L.: Bundar Abbas, November 1931. This species is very common on the sand at low water and seems to be partial to the wet hollows between ripple-marks. When walking it waves its long siphon about and the long foot is used like a whip to right itself if it gets turned over. If a specimen be held in the hand the hind end of the foot is lashed about in the attempt to right itself. These examples may be a local race, as this variable species is found from the Red Sea to Philippine Islands. As Dr. H. A. Redher determined the specimens I sent him as ? *hirta* (Sowerby) and Mr. Tomlin named them *pullus* (L.), I feel there is some ground for this suggestion.

Oliva bulbosa Röding: Muscat, 10 examples, 20.x.1922, dead shells purchased from Arab boys.

Pterocera bryonis Gmelin: Muscat Harbour, one example purchased from a fishing boat, 20.x.1922, and apparently recently alive, as the periostracum was perfect. Unfortunately over the years this has dried and mostly flaked off. The specimen is now in the British Museum.

Strombus beluchiensis Melvill: Hormuz Id., 5 examples, all dead. These are differently marked, from pale buff with few vermiculations to heavily marked so as to appear to be chestnut flecked with buff.

Siphonaria asghar Biggs. See *J. Conch.* **24**, 249. The type and one paratype are now in the British Museum.

Acteon sp. Hormuz Id., 2 living shells collected. I have found it difficult to determine these shells. They come near to *glabra*, but I have so far failed to trace the author of this name. They may be two different species, but until one can see a long series I feel it is inadvisable to separate them.

Bullaria ampulla (L.): Bundar Abbas, four dead shells only found on the beach, 12.v.1933.

Melampus lividus L.: Bundar Abbas, one fine living example found crawling on the stonework of the water-front, 14.v.1933, in association with *Littorina scabra* L. Compare the note on page 458 of Melvill & Standen (1901). If this species is not at present a marine form it is rapidly becoming so.

BIVALVIA

Arca (*Acar*) *donaciformis* Reeve: One living example, Hormuz Id.

Arca (*Acar*) *divaricata* Sowerby: Three living examples, Bushire 7.v.35. Rather small examples for the species.

Arca (*Barbatia*) *nivea* Chemnitz (= *helblingi* Brugière): Many seen under rocks on Hormuz Id., three only in my collection now.

Arca (*Barbatia*) *sp.*: One living example from under a rock near Sabzabad, Bushire. A very fine specimen, but I have not been able to place it. There is a possibility it is a new species, but being only one I hesitate to describe it.

Trigonodesma sculptilis Reeve: Two living examples, Bushire, 6.v.35.

Isognomon anomoides Gould: Hormuz Id., four living examples on the rocks.

Pinctada vulgaris Shumacher: Hormuz Id., two living examples.

Pinctada margaritifera L.: Bahrein Id., 24.x.1922. One shell given me by a pearl merchant.

Ostrea (*Alectryonia*) *cucullata* Born: Hormuz Id., a mass of this species of shell which seems to grow in colonies.

Spondylus gloriandrus Melvill: One example collected on Hormuz Id. alive carries in its shell other species of Bivalvia including several examples of *Lithodomus sp.* It is also rich in other forms of life such as corals, serpulae, etc.

Chama brassica Reeve: Two living examples taken on the rocks on Hormuz Id. Possibly I took more: Mr. Tomlin, who named most of my species, may have had some in his collection. It is interesting that Melvill & Standen do not mention this species, but on page 841 of their list of 1906 they write " N.B.—Two or three other members of this family occur, but, being encrusted with nullipores, etc., afford almost insuperable difficulties in attempting their classification ". I was more fortunate, as my two examples are fairly free of these encrustations.

Solen sp. near *corneus* Lamarck: One young dead shell, Bundar Abbas, November 1931.

Meretrix meretrix (L.): Several living shells on sands at Bundar Abbas, November 1931, of a purple colour. Two fine living shells but quite white were taken in the same locality in May 1933.

Dosinia alta Dunker: Bundar Abbas, four dead shells, but in fine condition, May 1933. Melvill & Standen (1906) record the species for Karachi. This record therefore extends its range.

Hemitapes hiantina (Lamarck): One dead shell on beach, Bundar Abbas, 12.v.1933.

Mactra fauroti Jousseaume: Bundar Abbas, single valve on beach, May 1933. Melvill & Standen record the species from Karachi. A single valve may not be sufficient evidence that the species occurs in the Gulf, in view of the commercial contacts by shipping.

Tellina edentula Spengler: Bundar Abbas, one dead example, May 1933. Not in Melvill & Standen lists.

SCAPHOPODA

Dentalium octogonum Donovan: Bundar Abbas, 5 dead shells, November 1931.

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ON A NEW SUB-SPECIES OF *PLACOSTYLUS FIBRATUS* (MARTYN) FROM NEW CALEDONIA

By T. Pain

[Plate 8]

(*Read before the Society*, 16 *November* 1957)

Although the terrestrial species of the genus *Placostylus* found commonly in New Caledonia and adjacent islands are polymorphic to a degree and their identification is often excessively difficult and uncertain, when careful examination by a competent collector is made on the spot a number of distinct ecological races are found to exist and this is especially true of the more mountainous regions of the island, where distinct sub-species have developed after long isolation on mountain spurs, separated from others by terrain unsuitable to these snails.

In the Tiebagi Mountains above Kumac on the north-west coast Mr. C. H. Humble obtained in 1945, at an elevation of 1,250 feet above the sea, the very distinct and unusual form described herein. No other member of the group of *P. fibratus* was seen in this locality, the only other species taken being the quite different *P. pseudocaledonicus saxtoni* Kobelt and *P. curtus* (Crosse).

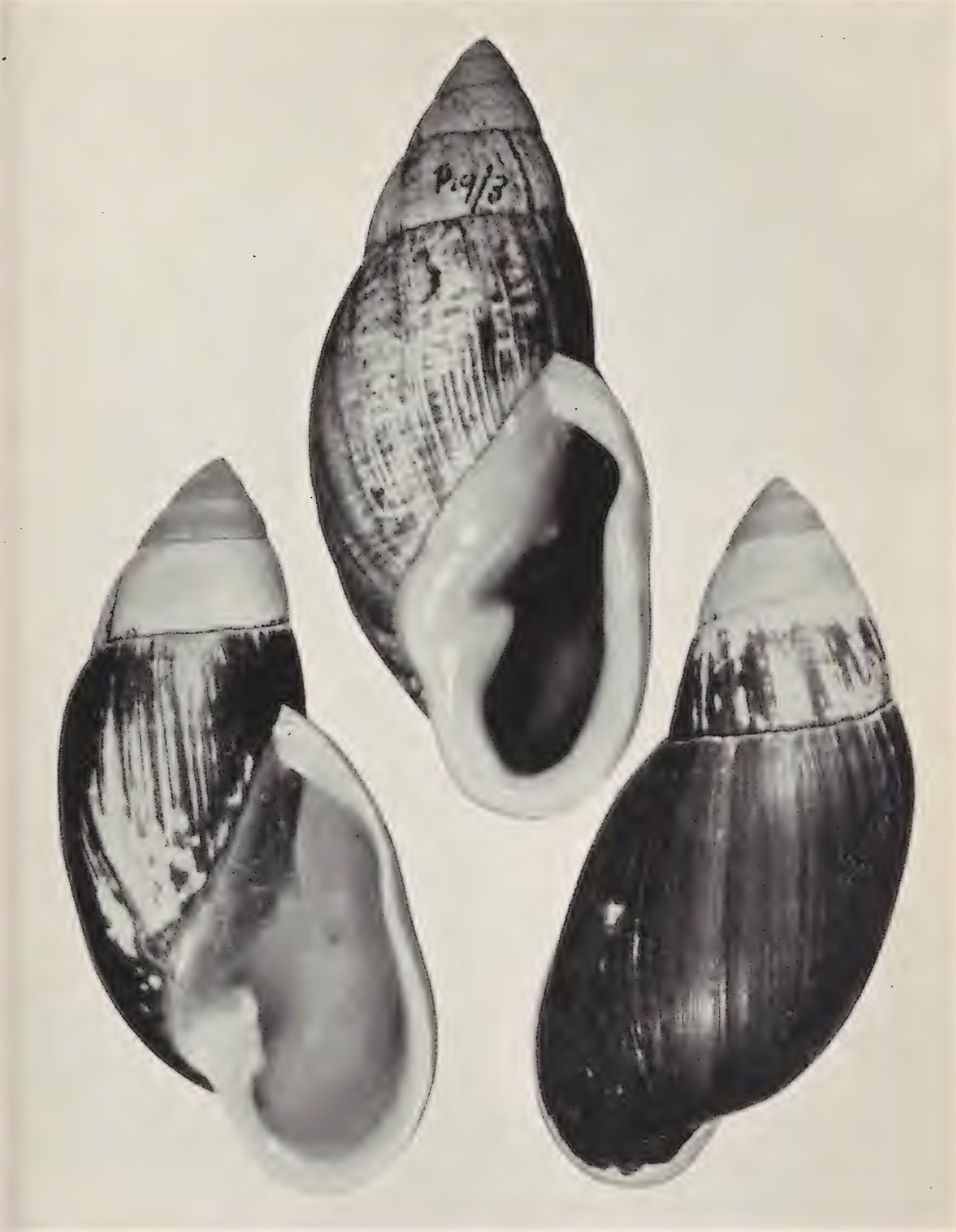
These snails, of which a number of living examples were collected, live in dense forest in damp places and are active only after rains. Pairing occurred in April and the elliptical eggs, 5 × 6 mm., are pure white, laid in a shallow pit and covered with dead leaves. The snails are eaten by the natives, but are rather leathery, the young ones however being softer and not unlike *Helix pomatia*.

Placostylus (Placostylus) fibratus kumacensis n. ssp.

Shell almost imperforate, elongate, moderately thick, longitudinally and transversely streaked, obliquely malleated, white under a buff-brown olivaceous periostracum, with traces of narrow brown bands upon the body-whorl. Spire conic, acute, flesh-coloured and destitute of cuticle. Whorls $7\frac{1}{2}$, slightly convex, separated by an impressed crenulated and white-bordered suture, the last two-thirds of the total length, compressed, ascending in front and flattened transversely towards the base. Aperture large, ear-shaped, orange-red and bluish-white within, long angular above, rounded below. Columella moderately thick and reflected over the umbilicus, rather flattened, with a long ascending and entering nodulous orange-red fold. Parietal callus moderately thick, bluish-white, bearing a strong orange-coloured tubercle. Peristome thickened, reflected, slightly sinuate above, rounded at the base.

Measurements (in Millimetres)

	Length.	*Max. diam.*	*Aperture.*	
(1)	104	50	64 × 29	Holotype
(2)	100	46	60 × 25	Paratype
(3)	98	44	58 × 25	,,
(4)	90	36	50 × 18	,,



Placostylus fibratus (Martyn).

[*To face p.* 276

Type locality :—New Caledonia, near Kumac on the north-west coast in the Tiebago Mountains at 1,250 feet (C. H. Humble, 1945). Holotype in the collection of the author.

This would appear to be the first recorded occurrence of any sub-species of *P. fibratus* in northern New Caledonia, all previous records being from the southern end of the island and from the adjacent Isle of Pines.

P. fibratus kumacensis shows but little variation save in the colour of the periostracum, which is considerably lighter in colour in young specimens. One abnormal immature example is noticeably perforate, but this is certainly due to injury.

The type locality of the original specimen of *P. fibratus fibratus* (Martyn, 1789) was unknown at the time of its publication, but as pointed out by Hedley in a letter to Pilsbry (1900, 235) at the time of Martyn's *Universal Conchologist*, no Europeans except Cook's party had visited New Caledonia. Therefore it was collected by them. Cook landed twice in New Caledonia, firstly at Balade, secondly at a " mere sandbank not exceeding three-fourths of a mile in circuit ", between the mainland and the Isle of Pines (see *Voyage of the Adventure and Resolution* **2**, 1779, p. 139, map opposite p. 24). This he called Botany Island (on modern French charts Île Amère).

Now the nominate race of *P. fibratus* does not occur at all in the north, and since Montrouzier lived for years at Balade itself we can confidently assert that it does not occur there, neither he nor Layard ever finding any trace of it at this place. There is therefore no escape from the deduction that Cook's people took it on Île Amère.

In the spring of 1945 Mr. Humble visited Île Amère and obtained there examples of *P. fibratus* which conform well to the original type. It would seem highly probable therefore that these specimens represent topotypes. Mr. Humble reports that it is however by no means common there, only one living example being obtained after a prolonged search, and the sub-species would appear to be verging on extinction, although it is still fairly common upon the adjacent Isle of Pines.

Since Martyn's figure is a very poor one, opportunity is taken to refigure this sub-species from the only living example collected. Pilsbry (1900) gives a copy (pl. 15, fig. 15) of Martyn's figure.

The writer is much indebted to Mr. Humble for the opportunity to examine and describe material collected by him in New Caledonia and to Mr. J. A. Willson for photographing the specimens for reproduction herein.

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EXPLANATION OF PLATE 8

Top figure : *Placostylus fibratus fibratus* (Martyn), Île Amère, New Caledonia. Height 91 mm.

Two lower figures : *P. fibratus kumacensis* Pain, Kumac, New Caledonia (holotype). Height 104 mm.

A NOTE ON *HELICODONTA OBVOLUTA* (MÜLLER)

By S. P. Dance

(*Read before the Society*, 16 *November* 1957)

Mr. H. Beeston has given such an admirable account of the habits of this interesting snail (*J. Conch.* **16**, 31–36, 44–50), that it would be difficult to add anything significant to it; contributions to our knowledge of this species in the British Isles must now be but minor additions to his exhaustive paper. This little note is one such.

Speaking of habitats Beeston says (*op. cit.* 46): " Beech woods generally are almost destitute of herbaceous vegetation, and in the denser portions this is particularly noticeable. Patches of dog's mercury sometimes occur on the outskirts together with the wild anemone, but never yet have I found *H. obvoluta* among or near either of these plants, although *H. striolata* occurs quite commonly on the former plant."

My first acquaintance with this species was in Bepton Hanger, West Sussex, situated on the north slope of the South Downs, on 7 July 1957, where specimens were found in some abundance. In nearly every instance the snails were taken amongst decaying wood and beech leaves quite buried under a thick carpet of dog's mercury (*Mercurialis perennis*). At the time I was not familiar with Beeston's statement and so made no particular study of the association. Mr. M. Goodchild, who is actively studying this species in West Sussex, assures me that he is in the habit of looking for *H. obvoluta* in such situations, and Mr. A. E. Ellis agrees that it is frequently found amongst dog's mercury.

HALIOTIS SPECIOSA, A SOUTH AFRICAN SPECIES

By Robert R. Talmadge

(*Read before the Society*, 16 *November* 1957)

Some recent comparisons of the marine snail, *Haliotis*, indicate that the identification of a South African species may have been in error for some time. One of the features of this genus is the variation in the age stages between juvenile, subadult, adult and senile within a given species. Also it has been noted that there are variations due to local conditions, and within the geographical range of a given species. Thus, a single species may have indications of two or more species.[1] This appears to have been the case in one of the South African Haliotids.

In 1955 the writer obtained two specimens of a Haliotid from Pondoland. One was a highly coloured adult shell about two and a half inches in major diameter, and the other a smaller somewhat blurred subadult of one and a quarter inches major diameter. The identification of the shells was unknown, as only the locality was on the label. By a comparison of both description and figures, the tentative identification was *Haliotis speciosa* Reeve, a species of which the habitat is unknown. Later, through the courtesy of the Natal Museum, their series of the smaller Haliotids was examined and another adult specimen located. This was also tentatively identified as *H. speciosa.*

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[1] Talmadge, R. R. Variation factors in the Haliotidae, read at the A.M.U. (Pacific Division), Stanford University, 1955.

Bartsch (1915) described from the Turton Collection a species represented by two specimens from Port Alfred, as *Haliotis alfredensis.* His description and figures came very close to the juvenile of the Pondoland specimen.

Two South African collectors, Mrs. H. Boswell of Johannesburg and Mr. D. H. Kennelly of Uitenhage, aroused the writer's suspicion by reference to the coloration of the little known *alfredensis* as being scarlet and cream. This matched the coloration of the supposed *speciosa.* A review of the available data was made, and it was finally decided to see if the original type material was still in existence. It was found that the original lots were available for comparisons, so the smaller or subadult specimen was dispatched. In the case of the smaller specimen, the distinctive coloration or pattern of the adult could not be used, but comparisons would be made on shell characteristics. Colour had been found to vary from specimen to specimen, but the basic shell features remained rather constant.

Mr. I. C. J. Galbraith of the British Museum (Natural History) checked the specimen with the set in the Hugh Cuming Collection, the specimens used by Reeve in his original work. The specimen corresponds to *H. speciosa*, validating the writer's tentative identification. The same specimen was then dispatched to Dr. Rehder of the Smithsonian Institution in Washington, D.C., and compared with the type of *H. alfredensis* Bartsch. Again the report was that the specimen matched the type. Therefore the earlier name must take priority, and *alfredensis* Bartsch becomes a synonym of *speciosa* Reeve. The confusion is easily understood, as so few specimens are available for comparison. The writer was extremely lucky to have both adult and subadult represented. It is therefore proposed that the following synonymy be used.

Haliotis speciosa Reeve, 1846, *Conchologica Iconica.* **3**, sp. 47.

Haliotis alfredensis Bartsch, 1915, *Bull. U.S.N.M.* No. 91.

Range : South Africa, Indian Ocean, from Port Alfred north into Natal, probably further north.

An ovate, smooth, finely corded, rather flat Haliotid, with bright scarlet and cream markings. In adults the blotches are more or less regular, bounded with a dark to black edging. The relationship of this species appears to be more close to some of the highly coloured *H. tuberculata rosacea* Reeve from the West Coast of Africa rather than *H. midae* of South Africa. The animal is unknown. It is hoped that other collectors working the South African and Natal coasts will watch for this species, so that a complete growth series may some day be available. The anatomy is also needed for comparisons in this and related species.

VIVIPARUS EATEN BY CROWS

By T. E. Crowley

In March 1957, in a small wood on the west bank of the River Colne, almost exactly where the counties of Buckinghamshire, Middlesex and Hertfordshire meet, I found what appeared to be a thrush's " anvil " of rather unusual type. This consisted of about thirty feet of old iron railing running parallel to the river about ten feet away from its bank and mounted on an old wall about five feet above river level. This railing was copiously marked with the droppings of the bird, and broken snail shells could be seen lying along its base. Although *Arianta arbustorum* (L.) and *Helix nemoralis* L. occur plentifully in the wood, the bird's food consisted entirely of *Viviparus viviparus* (L.) and a quick count indicated the remains of about a hundred individuals. With the exception of one or two which had obviously been dead shells when captured, each individual had been dealt with in the same manner. The outer margin of the shell had been snapped off in small pieces until about half the body whorl had been removed. This could only have been done by holding the shell against the rail of the fence with one foot ; there was no sign of the more usual method of hammering the shell against a flat surface, although plenty of flat stones were available nearby (see Pitchford, 1955, *J. Conch.* **24,** 40).

The river in this district winds a little and there are shallow patches of still water covering a pebbly bottom at a depth of only a few inches. There are no river weeds for some distance and I was unable to find live *V. viviparus* in the immediate locality.

I communicated these circumstances through the Edward Grey Institute of Field Ornithology to the Rev. Peter Hartley, who commented as follows :—

> " 1. I think it is certain that this is not a thrush's anvil. Song thrushes deal with snail shells in a rigidly uniform manner, quite different from that which has been employed here. I have watched Song Thrushes deal with (literally) hundreds of snails and always by holding the shell by the outer lip of the body whorl and cracking away the top of the columella and the region around it. I am prepared to state categorically that a Song Thrush never grasps its prey with one or both feet when " butchering " it.
>
> 2. I think that the anvil is that of one of the Corvidae : I would be even more explicit, and suggest that it is almost certainly that of a Carrion Crow. Crows, of course, do use their feet to hold their preys during the " butchering ". Carrion Crows are much given to hunting along shore lines and the collection of prey from an inch or two of water would present no difficulties : such a feat would be far more difficult for a bird as small as a Song Thrush."

Since receiving this opinion, I have found a thrush's " anvil " of strictly orthodox pattern only a few yards away from the iron railing.

My thanks are due to the Director of the Edward Grey Institute and to the Rev. Peter Hartley for their conclusion of this matter.

DROUGHT RESISTANCE IN AN AFRICAN FRESHWATER BIVALVE

By S. P. Dance

(Read before the Society, 19 *April* 1958)

It is well known that a number of freshwater bivalves can resist drought to a remarkable degree and there are several records of bivalves existing out of their natural element for lengthy periods. Kew (1893, p. 28) quotes one or two cases, the most remarkable being that recorded by Gaskoin (1850, p. 244) concerning an Australian *Unio* which, having already survived in a dry drawer for 231 days, was packed up " after being tested in water " and sent to England. On arrival in this country 498 days after its capture it was " restored to its element, with full vital powers ".

The ability of freshwater bivalves to withstand desiccation obviously stands them in good stead, especially in the tropics where the water supply is liable to be wanting for several months of the year. References to this faculty in African bivalves are very few and one of the most complete accounts was that given long ago by Rang (1834) when describing his new species *Anodonta chaiziana* (= *Aspatharia chaiziana*). He says that it lives not only at the bottom of a flood channel left behind by the river but also on " the neighbouring flats alternately submerged and abandoned by the waters. It sinks itself into the mud to a depth of two inches . . . . . . but is soon left high and dry in the surrounding mud which breaks up with the heat of the sun leaving the mussel exposed to the rigours of this burning climate ". Winter comes and with it the floods which, " by their freshness seem to call these molluscs to new life." In a footnote to page 309 of this account Rang relates how one of these molluscs lived for 12½ months after being taken from its native river in Senegal and shipped to Algiers, exposed to " all sorts of temperatures " and sometimes " plunged into freshwater but never for more than two or three hours " to see if it was still alive. This account is the fullest I have been able to find concerning an African freshwater mussel.

I feel that it would not be overloading the literature on this interesting topic if a further case of resistance to drought in another member of the genus *Aspatharia* was related.

On 13 August 1957 Mr. Rodger Austin, a retired Development officer, came to see me at the British Museum (Natural History) and producing a freshwater mussel from his pocket asked me if it was still alive. The valves were still united and it was found impossible to insert a scalpel between them. Either the valves were firmly cemented with mud or some other substance or they contained a living animal. Mr. Austin then recounted the circumstances in which he had found the specimen and its subsequent fate, which seemed to preclude all possible chances of its being still alive.

He had found the mussel, one of several, in July 1956 when surveying in the Yaida Plain, Mbulu District, Northern Province of Tanganyika

(3° 58′ S. lat., 35° 1′ E. long.). This part of Tanganyika is not very well known and has been visited by very few Europeans. At the time of Mr. Austin's visit there was not a drop of water to be seen anywhere on the plain as the dry season was well started. He told me that it is dry in these parts from July to November and that the average rain-fall from December to June is 30 inches. Even in the rainy season there are only small pools to be seen. The plain is composed mainly of black cotton soil mixed with sand; there is clay below. Mr. Austin found his specimens in a shallow storm water gully. He could not very easily miss them for they were sticking up out of the sand each one quite three-quarters exposed. At the time it struck him as rather strange; to a conchologist accustomed to finding Unionidae in more or less extensive stretches of water it would have been truly astonishing to have come across freshwater mussels standing on end in the middle of a dry sandy plain with tufts of grass growing up between them. Mr. Austin picked up about ten specimens, eight of which proved to be still alive when he sent them to the Coryndon Museum at Nairobi in August the same year.

He returned to this country early in 1957 still possessing two of the mussels. One of them died very soon and Mr. Austin was not sure if the other, still closed, was alive or not. Apparently this specimen, the largest that he had picked up, had been carried about loose in his jacket pocket ever since it was first taken some 12½ months previously.

The specimen was put into a small dish of water and left overnight. The next day it was transferred to an aquarium in the Museum and left in a room with a constant temperature of 22° C. The following day it was found to be still alive and soon became very active. At the time of writing (31 March 1958) it is still just as active in the same aquarium.

This is certainly a remarkable case of resistance to desiccation, for at no time during these 12½ months was the mussel put into water, as were the specimens from Australia and Senegal already mentioned. What is more remarkable, however, is that these Tanganyikan specimens would otherwise have remained exposed for five months or so to all the vicissitudes of the African climate, more especially the extremes of temperature. Mr. Austin informs me that the temperature in July 1956 in the Yaida Plain area was about 25°–30° C. That this remarkable observation was most likely of an annual event is given support by Mr. Austin's discovery that the natives of the area, the Gisimajeng clan of the Tatog tribe, have a word for these mussels—*hebabaek*—which is also used to signify surprise.

From Mr. Austin's information and a sketch he supplied it seems likely that the mussels had the posterior portion of the shell buried in the sand but, as he says, their position "may be accidental and caused by storm waters before the gully dried up".

The specimen was not measured when it was first brought to me, but I do not think that it has added any more to its shell, which now measures 98 × 48 mm. The specimens sent to the Coryndon Museum were provisionally identified by Dr. B. Verdcourt as *Aspatharia petersi* (Mts.). On external characters this identification seems to fit the surviving specimen, though it will be necessary to examine the interior of the valves on the death of the occupant before this can be established.

ACKNOWLEDGMENTS

For helpful advice I have to thank Dr. C. A. Wright, and Mr. Austin for his close co-operation and permission to publish his field observations.

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A SHORT HISTORY OF THE KNOWN OCCURRENCES OF *HELICELLA GIGAXI* (L. PFEIFFER) IN IRELAND

By A. W. STELFOX

(*Read before the Society*, 17 *May* 1958)

IN March 1920 I received a letter from the late A. E. Boycott informing me that amongst the Roebuck MSS. he had found an authenticated record for *Helicella heripensis* Mab. (= *gigaxi* L.Pf.) and on the 19th of that month I received from him two undoubted specimens (one broken and both dead shells) together with the following label: " Camp ground, 3 miles N. of Kildare, E. Stainton. 14.3.'18." Later, 23 March 1920, I was informed that the original label sent by Stainton to his uncle, W. D. Roebuck, gave a little more information, as follows :—" 14.3.'18. Camp ground about 3 miles north of Kildare under stones and débris in a dry ditch. Situation rather dry but sheltered," and *Helix hispida* var. *concinna* (*teste* W. D. R.) which had apparently been taken in association with the *H. gigaxi*.

This record subsequently appeared in the *Journal of Conchology* (**16**, 102). I afterwards wrote Stainton, but could get no further information on the subject. In the *Irish Naturalist* of January 1922 (**31**, 11) I criticized the recorder, A. E. Boycott, for including *H. heripensis* in his report as definitely occurring in Ireland on the strength of two dead shells found on a camp ground during the war, where many English troops had been stationed, including cavalry, for the feeding of whose horses fodder might have been brought from anywhere and the dead shells with it. In March 1920 I had only just moved to Dublin and had previously collected very little in the Kildare area, but on 21 April 1924 I found a colony of *H. gigaxi* on the face of an old gravel pit behind the ruins of a large building (a disused flour mill ?) by the Grand Canal half a mile east of Sallins, in Co. Kildare, *i.e.* between 8 and 10 miles north-west of Stainton's station.

This discovery I reported in the *Irish Naturalist* (**33**, 67) and later in *J. Conch.* (**17**, 182), where reference to the *Irish Naturalist* was altered by the editor or printer into " Field Naturalist " through some error. This discovery of the species near Sallins settled the question of its *occurrence* in Ireland, for some of my specimens were alive, but it did not prove that it was *native*. As I was unable to find any trace of *H. gigaxi* except in the immediate precincts of the ruins of the mill, I ended my note in the *Irish Naturalist* with the following sentence : “ The finding of the snail on one of the untouched esker ridges of this part of the central plain would, I think, be satisfactory evidence that it is native.” It was not until September 1930 that the event just referred to happened, when the late R. A. Phillips found *H. gigaxi* in abundance on an esker—a steep sided sandy ridge of Glacial origin—at Culliaghmore, Co. Roscommon, on 21 September 1930. In forwarding me specimens, Phillips—who had previously expressed agreement with me as to the possibility of *H. gigaxi* having been introduced into its Kildare stations—informed me that the Culliaghmore habitat appeared to be far removed from any probable source of introduction and that he considered the snail undoubtedly native there.

A further period of twelve years elapsed before I myself met with it in an apparently native state. During the 1939–45 war much marginal land was broken up and grain grown upon it, and such a piece of land occurred on the northern slope of an esker south of the Grand Canal and about a ¼ mile east of Landenstown House, Co. Kildare. Here, while sweeping insects on the margin of a crop of oats, I found in my net specimens of *H. gigaxi*, and several times in later years I have had the same experience in the same locality on the esker. Landenstown House is a little over two miles due west of my station for *H. gigaxi* near Sallins and some 8 miles north-west of Stainton’s locality. There are many eskers in the Landenstown area and it is probable that the snail occurs in many places in the district, from which it might very easily have been carried with grain in times past to the mill at Sallins and during the 1914–18 war, with fodder perhaps, to Stainton’s camp. Its present known distribution in Ireland—Cos. Kildare and Roscommon—is unlike that of any other species of our Mollusca and difficult to explain. The Roscommon locality is separated from those in Co. Kildare by a tract of about 50 miles of the central plain, which has been traversed more often by geologists and botanists than by conchologists. Perhaps I had better explain that an “ esker ” is the Irish word for the many sinuous ridges of stratified sand and gravel left behind in the central plain of Ireland by the melting ice during the last phase of the Glacial Period in this area and that it is a term now adopted by students of glacial phenomena for similar moraines in all parts of the world.

THE A. W. STELFOX COLLECTION OF NON-MARINE MOLLUSCA

By NORA F. MCMILLAN

(*Read before the Society*, 14 *December* 1957)

IN 1956 the collection of land and freshwater shells made by Mr. A. W. Stelfox was acquired by the Liverpool Public Museums, and the purpose of this note is to draw attention to the location of the collection, and to some of its contents.

Naturally, Irish material forms the bulk of the collection, and every county is well represented. The non-marine Mollusca taken during the Clare Island Survey, upon which Stelfox's report (*Proc. Roy. Irish Acad.* **31,** part 23, 1912) was based, are included, as well as the Mollusca obtained during the earlier natural history survey of Lambay, Co. Dublin (*Irish Nat.* **16,** 41–2, 1907). There are also collections of the non-marine Mollusca of many of the Irish islands, from Rathlin in the north-east to the Blaskets in the south-west. These " island faunas " are being kept as a separate collection.

An important item is the set of *Lymnaea peregra* variations from the high-level lakes of the Caha Mountains, West Cork. These include " *involuta* Thompson ", " *praetenuis* Bowell " and other aberrant forms differing almost as widely from normal *peregra.* All these shells formed part of H. C. Huggins' original takings, upon which his paper " The Limnaeae of the alpine lakes in the Glengarriff District, West Cork " (*Irish Nat.* **27,** 119–128, 1918) was based.

The collection also includes much material from S.E. England and elsewhere, with French and Norwegian shells. There are also paratypes of Caziot's *Bithynella templi* and *Paludinella guittoni*, both received from Caziot through A. S. Kennard.

A rough estimate of the collection gives a total of about 2,560 sets of Irish material and 1,400 sets of British and foreign, approximately half of which is mounted in glass-topped boxes. All the material is accompanied by ample data, and Liverpool Museums may account themselves fortunate in being able to acquire the collection.

The Stelfox collection of *Pisidium* has not come to Liverpool with the rest of his collection, as the bulk of it was given in 1950 to the Rev. H. B. Herrington of Ontario, who in turn passed it on to the Museum of Zoology, University of Michigan, Ann Arbor, U.S.A. However, Liverpool Museums have 105 sets of *Pisidium*, mainly from N.W. England, which were determined jointly by Stelfox, Oldham and Phillips in 1918. These shells reached the Museum with the Standen-Jackson collections in 1936 and 1942. Attention is here drawn to the existence of this material, which is fully annotated by all three authorities.

THE VALIDITY OF THE NAME *EULIMA CANDIDA* MARRAT

By NORA F. MCMILLAN

(*Read before the Society*, 14 *December* 1957)

MARRAT's description of his *Eulima candida* is usually quoted as having appeared in *Proc. Lit. and Phil. Soc. Liverpool* No. 34 (1879–1880), published 1880. Recent inquiries, however, have revealed a rather peculiar state of affairs, and it now seems doubtful if the name should stand.

Marrat issued a number of privately printed leaflets dealing with Mollusca, many describing and figuring new species, and some of these leaflets were afterwards published in a slightly different form in various journals. That describing *Eulima candida* is a single 8vo page of text facing a plain plate illustrating the species, and is titled " *Eulima candida* (The Shining-white), Marrat ". It is signed " F. P. Marrat, Scientific Staff, Free Public Museum, Liverpool " and dated 4 July 1880. Another leaflet, identical save that the title runs " *Eulima candida*, Marrat ", exists, also dated 4 July 1880, and is listed by the British Museum (Natural History), who add " Also issued with Vol. 34 of *Proc. Lit. and Phil. Soc. Liverpool* ". E. A. Smith (*J. Conch.* **4**, 282) gives the reference for *E. candida* as *Proc. Liverpool Phil. Soc.* 1880, p. 339. Upon consulting Vol. 34 (more properly No. 34 as the *Proceedings* were then entitled) it was found that the volume was made up as follows :—

(*a*) pp. 1–337 *Proceedings.*
(*b*) Unpaged " *Eulima candida*, Marrat " leaflet.
(*c*) appendix " On the Varieties of the Shells belonging to the Genus *Nassa*, Lam." by F. P. Marrat, pp. 1–96 (p. 96 blank).

The *Eulima* leaflet is not paged, nor the plate numbered, nor does the title appear in the " Contents " to the volume nor in the general index to Vols. 1–50 of the *Proceedings*. The volumes of *Proceedings* were distributed bound in cloth, and the several copies of No. 34 which I have examined all contain the *Eulima* leaflet, so there is no question of a special volume containing it having been bound. It looks as if copies of the *Eulima* leaflet were supplied too late for inclusion in the " Contents " for the volume, and were just slipped in at the end of the *Proceedings*, before the *Nassa* appendix. I am not clear as to whether this constitutes publication as usually understood.

Vitrina major (Férussac) in Surrey : a correction.—On p. 238, figures 1 and 2, the ocular retractor muscle should have been drawn passing to the left of the penis, and not passing below it and across the sperm duct and vagina as in the figures. In figure 2, the duct of the spermatheca should enter the atrium directly, not the distal end of the oviduct as drawn.

H. E. QUICK.

CLAUSILIA BIDENTATA (STRÖM) WITH DOUBLE APERTURE

By Hans Schlesch, Phil.D., D.Sc.

(*Read before the Society*, 16 *November* 1957)

Records of Clausiliidae with a double aperture to the shell are to be found only rarely in the literature. Rotarides and Schlesch (1951, *Acta Biologica Academiae Scientiarum Hungaricae*, **2**, 106–108) have compiled 46 instances from the scattered literature, but there may be many more. I am now able to give two new records of *Clausilia bidentata* with duplicated aperture :—

Sweden : Fraggberget, Vestmannland, 23 May 1956, H. Waldén.

Denmark : Farnæs Skov, Sortsö, N. Falster, 16 September 1957, H. Schlesch.

Besides these the following records are known for this species :—

France : A. Moquin-Tandon, 1855, *Histoire naturelle des Mollusques terrestres et fluviatiles de France*, **1**, 324, pl. 24, fig. 19.

England : Luton, Bedfordshire, J. Saunders, in J. W. Taylor, 1895, *Monograph of the Land and Freshwater Mollusca of the British Isles*, **1**, 119, fig. 267.

Yealand Conyers, north of Carnforth, Lancashire, J. W. Jackson, 1910, *Lancashire Naturalist*, **3**, 275–276, and *J. Conch.* 1911, **13**, 161 (text figure).

Melling, J. Davy Dean, 1911, *J. Conch.* **13**, 152.

(Note : It is not stated to which of the two places of this name, both in Lancashire, this record refers ; one is north of Liverpool, the other in the Lune valley between Lancaster and Kirkby Lonsdale).

Lathkil Dale, near Bakewell, Derbyshire, J. Ray Hardy, 1911, *J. Conch.* **13**, 190.

Malham, Yorkshire, L. W. Stratton, 1956, *J. Conch.* **24**, 120.

Northern Ireland : Cave Hill, Belfast, H. L. Orr, 1900, *J. Conch.* **9**, 374.

Cochlicella acuta (Müller) : another colony in Sussex.—On 30 September 1957, I visited Holy Well near Eastbourne and followed the narrow road between the houses on the seaward side of the coast road just before it turns inland at the foot of Beachy Head downs. This narrow road runs to the edge of the cliffs and continues as a steep path down to the beach. About twenty yards along this path I came upon a large colony of *Cochlicella acuta*. The position of this colony corresponds almost precisely with the locus marked with a *triangle vide* under the " G " of " Gap " (Birling Gap) indicated on the map (fig. 2, p. 256) illustrating the paper by De Leersnyder and Hoestlandt.

F. H. Cozens.

(*Read before the Society*, 15 *March* 1958.)

REVIEWS

Studies on Loch Lomond: I. HARRY D. SLACK. Pp. x, 133, 4 half-tone plates, 21 text-figures, 3 maps. Published for the University of Glasgow by Blackie and Son, Ltd., 1957. 15*s.*

IN 1946 the University of Glasgow established a laboratory in the grounds of Rossdhu House, Dunbartonshire, near the southern end of Loch Lomond, and this volume gives an account of the researches carried out from the new field station during its first decade. Dr. H. D. Slack has written the introduction and chapters on the topography, physical and chemical data, and fauna of the loch, while other contributors have dealt with "The maintenance of isolated faunas", the midges (*Culicoides* and *Chironomidae*), the biology of the powan (*Coregonus*) and the parasites of fishes. The longest chapter is that of primary concern to students of Mollusca—on the freshwater snails, by Dr. W. Russell Hunter. These forty pages constitute an important contribution to malacology and merit the attentive study of all interested in the biology of freshwater Gastropoda. The drawings of *Planorbis* are amongst the best we have seen and whet the appetite for more.

Pacific Sea Shells. A Handbook of common marine Molluscs of Hawaii and the South Seas. SPENCER WILKIE TINKER. 2nd edition, 1958. Pp. 240, including 104 plates. Charles E. Tuttle Company, Rutland, Vermont. $3·25.

THIS book, by the Director of the Waikiki Aquarium, University of Hawaii, is written for the amateur collector and, as the author states, "is primarily a guide to the larger and more common shells of the Hawaiian Islands and the area lying to the south and west of this group." The greater part of the book is taken up with Gastropoda, there being one species of Amphineura, one of Scaphopoda and three of Cephalopoda. Bivalvia are omitted, which is a pity unless the author intends to deal with these in another volume. The arrangement of the families follows that of two Japanese authors, Kuroda and Habe; that of the species is based partly on an unpublished Hawaiian check list. This results in some unfamiliar names: for instance, some fine figures of *Conus litteratus* are called *C. leopardus*, and the species of *Pustularia* are all placed in *Cypraea*. A minor blemish is that *Charonia tritonis*, though correctly place in the family Cymatiidae, is given the generic name of *Tritonalia*, which belongs to the Muricidae.

The descriptions are quite adequate for the purpose for which the book is intended, and the notes on distribution are generally well given, although eight species stated to extend to New Zealand do not occur there. The plates, all from photographs, vary a good deal in quality; many are excellent, but the figures of dark coloured shells merge into the background and are difficult to distinguish. An unusual feature in modern books is that in all but eleven of the plates of Gastropoda the shells are depicted apex downwards. The book, printed in Japan, is attractively produced and should prove of considerable use to collectors interested in the shells of the North Pacific Ocean.

L. W. STRATTON.

The Kingdom of the Octopus : the Life-History of the Cephalopoda. Frank W. Lane. Pp. xx, 287 ; 53 pl. (5 coloured) and 13 text-figures. Jarrolds, London. 21 October 1957. 30*s*.

In the introduction to this popular book on octopuses and squids, Mr. Frank W. Lane declares his aims to be a volume " which will interest the layman, be useful to the student and satisfy the teuthologist ". There is no doubt that he has succeeded admirably in the first of these aims, for he has brought together much interesting and little-known information, and has amassed the best collection of cephalopod photographs ever published.

He begins by reviewing the salient morphological features of selected species, and in further chapters goes on to discuss food, enemies, locomotion, behaviour, colour, luminescence and reproduction. Later chapters deal with fishing for cephalopods, their economic importance, the controversial subject of dangerous species, and, under the title *Kraken*, the giant cephalopods.

Mr. Lane has seized on many topics of popular appeal in cephalopod biology, so that the layman will find this book both instructive and entertaining. In the text he quotes a very large number of people with whom he has been in correspondence, and, in general these quotations are pertinent and interesting. Occasionally these opinions give the impression of being new contributions to knowledge, whereas in fact they are drawn from the published accounts of others and are already accepted by most experts in the field. A more serious fault is that the author has not critically assessed the scientific value of the statements he has drawn from expert and non-expert, and this is why the book is not entirely suitable for the student. He quotes for example a curious suggestions by Professor Adolf Portmann (p. 117) concerning the *Doratopsis* stage of *Chiroteuthis*. According to Portmann : " It remains to be elucidated if this larval form can attain, exceptionally or regularly in certain species, sexual maturity." There is no call for speculation here, for there is no evidence to suggest that development is abnormal ; fewer adults than larvae are taken in expedition nets, but this is true also for most bathypelagic squids of similar size and merely reflects man's inability so far to devise suitable nets to capture them as adults.

At this point it may be appropriate to mention some minor errors. *Sepia officinalis* is not confined to the N.E. Atlantic as suggested on p. 13, but is found as far south as the Cape of Good Hope. The hooks on the tentacle clubs of *Galiteuthis* (pl. 9, facing p. 36) are not retractile into sheaths as stated ; the so-called fleshy hood is merely secretory in function and responsible for the formation of the hook itself. It shrinks away when its task is complete.

When discussing an encounter between an octopus and *Conus textile* (pp. 444–45), the author does not seem to be aware that this cone shell is one of the venomous ones, capable of killing not only octopuses but human beings also with its poison.

Mr. Lane repeats the story of an octopus waiting patiently by a bivalve shell until the valves opened, and then popping in a stone to prevent closure. This ancient story (last quoted by Hornell as his own in a popular article) is no longer thought to be true, but it is resurrected here, and so are Denys de Montfort's sensational, fictitious tales of giant cephalopods causing the sinking of men o' war. All this makes very good reading, but it detracts from the value of the book as a serious contribution to the study of cephalopods.

W. J. REES.

Molluscan mortality at Youghal, Co. Cork.—Further to the report of the Rev. Professor L. W. Grensted (*J. Conch.* **24,** 145) on the effects of a gale on the South Lancashire coast, I can now report a very high molluscan mortality at Youghal, East Cork, in the last week of March and the first week of April 1958. The beach at Youghal consists of a gently sloping strand about four miles in length, the surface being principally sand with occasional patches of gravel and light shingle. The beach runs W.S.W. and curves gently to almost S.W. at its western extremity. On visiting Youghal on 7 April, I was informed that there had been strong east and south-east winds of almost gale force for the previous 10 to 14 days. On examination of the beach I found that from Claycastle (a point west of the sea front of the town where the beach proper begins) westwards there were at high-water mark great quantities of shells of *Mactra corallina cinerea* Montagu in an almost continuous line along the beach for about three miles, at intervals forming considerable drifts. These shells appeared to be young individuals, the average length being about 2·5 to 2·5 cm., whereas the average length of beach specimens taken there on previous visits was 3·5 to 4·5 cm. The soft parts were present in most of these shells, though in an advanced stage of decomposition. Also present, though in quantities only slightly above the average for the area and represented by fully grown specimens, were *Mya truncata* L., *Lutraria lutraria* (L.), *Ensis ensis* (L.), *Donax vittatus* (da Costa), *Cardium edule edule* L. and *Spisula solida* (L.), the last being a very common species in the area. Shells of *Buccinum undatum undatum* L. were also present, many still containing the dead animal and showing evidence of damage, presumably caused by severe battering by the surf. Though not present in large quantities, the number of these was about the general observed average.

L. S. ATKINS.

(*Read before the Society,* 17 *May* 1958.)

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND

758th Meeting, held at the British Museum (Natural History), 16 November 1957

Mr. A. E. Ellis, vice-president, in the chair.

Member Deceased

The chairman announced the death of Dr. Henry Augustus Pilsbry, senior honorary member of the Society, on 26 October.

Members Elected

Eric C. Badcock, Elbury, Bassetsbury Lane, High Wycombe, Bucks.
John Coleman Cooke, Simonsbath Lodge, Simonsbath, Minehead, Somerset.
Miss Jennifer Crowley, B.Sc., A.I.M.L.T., Red Cottage, Ompton, Newark, Nottinghamshire.
Richard Falkiner, c/o Glendining and Co., Ltd., 7 Blenheim Street, London, W. 1.
Michael Goodchild, 2 Russell Street, Chichester, Sussex.
H. A. P. Ingram, 64 Clifton Road, Rugby, Warwickshire.
Mrs. Henrietta Margaret Jope, Queen's University, Belfast, Northern Ireland.
Alberto Malatesta, Dr.Sc., Geologo Capo, Servizio Geologico d'Italia, Largo S. Susanna 13, Rome, Italy.
Miss Dorothy L. Palmer, 14 St. James Road, Harpenden, Hertfordshire.
L. C. Prebble, 147 Ashford Road, Feltham, Middlesex.
A. Rombouts, 25 van der Merwe Street, Rietondale, Pretoria, South Africa.
Rev. Herbert Edward Whitten, 1710 Great North Road, Avondale, Auckland, S.W. 3, New Zealand.
Miss Elizabeth M. Wistar, Buttonwood Farm, 200 Montgomery Avenue, Chestnut Hill, Philadelphia 18, Pennsylvania, U.S.A.
Miss Gay Woodgate, 20 Gloucester Place, London, W. 1.

Communications

" *Clausilia bidentata* (Ström) with double aperture," by H. Schlesch.
" A note on *Helicodonta obvoluta* (Müller)," by S. P. Dance.
" *Viviparus* eaten by crows," by T. E. Crowley.
" A new subspecies of *Placostylus fibratus* (Martyn) from New Caledonia," by T. Pain.
" *Haliotis speciosa*, a South African species," by R. R. Talmadge.

Exhibits

Special exhibits: Magilidae and *Orthalicus*. Examples from the British Museum collections were shown by Mr. S. P. Dance.

Mr. R. W. Greenish: *Mactra glauca* Born, Belvoir Bay, Herm, Channel

Islands; dead shells of cowries found on British beaches, viz. *Pusula pediculus* and *P. suffusa*, Freshwater West, Pembrokeshire, and *Trivirostra oryza*, Trevose Head, Cornwall.

Dr. H. E. Quick: photographs by W. V. Ward of a Conus devouring a fish, from *Honolulu Star-Bulletin*, 28 October 1957.

Mr. L. W. Stratton: *A Child's Book of Sea Shells* by W. M. Hutchinson, 1954; *Shells of New Zealand*, 3rd edition, by A. W. B. Powell, 1957.

759th Meeting, held at the British Museum (Natural History), 14 December 1957

The President, Mrs. N. F. McMillan, in the chair.

Member Elected

Miss Lesley Frances Hanna, c/o Barclays Bank, Ltd., 108 Queen's Gate, London, S.W. 7.

Communications

"The A. W. Stelfox collection of non-marine Mollusca," and "The validity of the name *Eulima candida* Marrat," by Mrs. N. F. McMillan.

Exhibits

Special exhibits: *Polymita* and *Xenophora*. Examples were shown by Mr. C. P. Castell and Mr. S. P. Dance (from the British Museum collections), and by Mr. R. P. Scase, who also exhibited specimens of *Halia priamus*, *Magilus antiquus* and *M. robillardi*. Mr. Dance showed a portrait of Hugh Cuming. The President exhibited photographs of living slugs taken by Mr. G. D. Hyslop.

760th Meeting, held at the British Museum (Natural History), 18 January 1958

Mr. A. E. Salisbury, vice-president, in the chair.

Member Elected

John Machin, 55 Gubyon Avenue, Herne Hill, London, S.E. 24.

Exhibits

Special exhibits: Turritellidae, *Margaritifera*. Examples were shown by Mr. C. P. Castell and Mr. S. P. Dance (from the British Museum collections) and by Mr. T. Pain. Other exhibits were genital structures in *Achatina albopicta* by Mr. M. Goodchild, and shells of *Carychium* prepared to show the columellar fold by Dr. H. E. Quick.

Museum Collections and Library

Mr. Dance pointed out that owing to the introduction of the five-day week at the British Museum, members of the staff of the Mollusca Section were no longer on duty on Saturday mornings.

Mr. Dance stated that, in order that members might have access to the books and collections, he was willing to be at the Museum from 11 a.m. on the meeting days of the Society.

A vote of thanks to Mr. Dance was passed.

761st (Annual) Meeting, held at the British Museum (Natural History), 15 February 1958

Dr. H. E. Quick, vice-president, in the chair.

Member Deceased

The chairman reported the death, on 26 January, of John Francis Hayward, Ph.D., M.Sc., F.G.S.

Election of Scrutineers

Mrs. M. Ainsley and Mr. G. W. Pitchford were elected Scrutineers.

Election of Auditors

Miss M. Maitland Howard and Mr. S. P. Dance were elected Auditors.

Annual Reports

The reports of the Council and of the Recorders were presented and adopted.

Statement of Accounts

The retiring Hon. Treasurer, Mr. A. E. Salisbury, presented the audited accounts for 1957, which were adopted. Tributes of gratitude and appreciation were paid to Mr. Salisbury, who had held office since 24 November 1939.

Votes of Thanks

Votes of thanks were approved to the Trustees of the British Museum (Natural History) for permitting the Society to hold meetings in the Museum, to the Keeper of Zoology and to Mr. I. C. J. Galbraith for allowing members of the Society facilities to use the Molluscan library and collections, and to the Officers and Council for their work on behalf of the Society.

Presidential Address

In the absence of the President, Mrs. N. F. McMillan, through indisposition, her address entitled " Notes on some Orkney snails " was read by the Hon. Secretary.

Election of Officers and Council

The Officers and Council were declared as shown on page **269**.

Exhibits

Rev. H. E. J. Biggs : Series of *Eobania vermiculata* illustrating its distribution and variation in the Mediterranean region.

Mr. C. P. Castell : Selection of Tertiary fossils from the collection of the late A. G. Davis.

Mr. T. E. Crowley : Cameo carved on a shell of *Cassis madagascariensis*.

Mr. S. P. Dance : Two shells of *Conus gloria-maris* from the British Museum collections ; William Bean's copy of *The Malacological and*

Conchological Magazine, conducted by G. B. Sowerby, parts 1 and 2 (1838–39); George Walker's *Testacea minuta rariora* . . . (1784).

Mr. M. P. Kerney: David Dyson's *Land and freshwater shells of the districts around Manchester* (1850) with a portrait of the author.

Mrs. E. M. Morehouse: land shells from Sarawak collected by Charles Hose.

Mr. G. W. Pitchford: British and foreign marine shells; a notebook of records of Mollusca of Nottinghamshire.

Mr. R. P. Scase: *Cypraea sulcidentata* and *C. tessellata*, Oahu, Hawaii, collected at depths of 30–45 feet by "aqualung" diving.

Mr. L. W. Stratton: North American land shells.

Report of the Council

Membership has increased by seven during the year to a total of 196, including eight honorary members. The Society has lost by death the following members: Dr. J. G. Baldacchino, Mr. A. G. Davis, Dr. J. F. Hayward, Dr. H. A. Pilsbry, Mr. G. L. Wilkins and Mrs. A. M. Winckworth. Dr. Pilsbry, one of the most eminent conchologists of his time, was our senior honorary member. The loss of Mr. Davis and Mr. Wilkins, both past presidents and most enthusiastic supporters of the Society, is a severe blow. There were only two resignations, but the names of several members whose address is unknown were deleted from the list of members by the Council.

Seven ordinary meetings and an annual general meeting have been held at the British Museum (Natural History) by kind permission of the Trustees. Field meetings were held at West Horsley, Surrey and Burnham Beeches, Bucks.

Two numbers of *The Journal of Conchology* were issued, namely volume 24, No. 5, 4 January, and No. 6, 26 June 1957.

Recorder's Report: marine Mollusca

Mr. G. W. Pitchford has submitted a number of species from the Isle of Walney, North Lancashire, and Silecroft, Cumberland, all additional to those recorded in volume 23, p. 278. The most interesting is *Clathrus turtonis* (Turton), of which a dead shell was obtained.

A shell of *Crepidula fornicata* (L.) was picked up on the shore of the Dee estuary at Caldy, Cheshire, by Mr. N. F. Ellison about 1952 and given to the Recorder.

A shell of *Monodonta lineata* (da Costa) was taken at Whitstable, Kent, by Messrs. Perkins and Maghraby (*Ann. Mag. Nat. Hist.* (12) **9**, 481–498, 1956), which I have seen through the kindness of Dr. Newell. It looks recent, but it is impossible to tell how far a shell can drift. The nearest known station for the species is Golden Cap, Dorset.

The true *Mytilus galloprovincialis* Lamarck has been shown by B. T. Hepper (*J. Mar. Biol. Assoc.* **36**, 33–40, 1957) to occur in south-west England and Wales, from Plymouth to Tenby, and at Castletownbere, Co. Cork. The species is intolerant of brackish water and hence is absent from many inlets in the south-west.

NORA MCMILLAN.

Recorder's Report : non-marine Mollusca

Since the last report (vol. 24, p. 222) the following records have been authenticated :—

Sussex West (13) : *Acicula fusca*, Bepton, S. P. Dance ; *Anodonta minima* (p. 220).

Kent East (15) : *Cochlicella acuta* (p. 259).

Kent West (16) : *Acicula fusca* (p. 233).

Surrey (17) : *Vitrina major* (p. 235) ; *Melanoides tuberculata* (alien, p. 268).

Berks (22) : *Anodonta minima*, Cookham, S. P. Dance.

Pembroke (45) : *Acanthinula lamellata*, *Retinella pura*, *Oxychilus helveticus* (p. 252) ; *Monacha cantiana* (p. 244).

Nottingham (56) : *Arion rufus*, Sherwood, G. W. Pitchford.

Lancaster South (59) : *Milax sowerbyi*, Liverpool, Mrs. N. F. McMillan.

Lanark (77) : *Acanthinula aculeata*, Hamilton Park, W. Russell Hunter.

Peebles (78) : *Potamopyrgus jenkinsi*, Leadburn, T. Warwick.

Berwick (81) : *Potamopyrgus jenkinsi*, Coldingham Loch, T. Warwick.

Haddington (82) : *Potamopyrgus jenkinsi*, Balgone, North Berwick, T. Warwick.

Edinburgh (83) : *Planorbarius corneus*, Union Canal, Craiglockhart, T. Warwick.

Dunbarton (99) : *Monacha granulata*, Cardross ; *Valvata cristata*, *Sphaerium lacustre*, *Pisidium nitidum*, Forth and Clyde Canal, Bowling ; *Pisidium subtruncatum*, Loch Lomond, W. Russell Hunter ; *Pisidium conventus* (p. 245).

Orkney (111) : *Cochlicopa lubricella*, Hoy, Mrs. N. F. McMillan.

Wexford (127) : *Planorbis laevis* (dead shell), Johnstown, Mrs. N. F. McMillan.

A. E. E.

762nd Meeting, held at the British Museum (Natural History), 15 March 1958

The President, the Rev. H. E. J. Biggs, in the chair.

Members Deceased

The President reported the deaths of Philip Pomeroy Milman and Tinsley Owen Tippet.

Member Elected

Frederic de Havas, Dr. rer. pol. (Vienna), Holmbury House, Holmbury St. Mary, Dorking, Surrey.

Communications

" *Cochlicella acuta* (Müller) : another colony in Sussex," by F. H. Cozens.

" Littoral collecting in the Persian Gulf," by the Rev. H. E. J. Biggs.

Exhibits

Special exhibit : *Anomia*. Mr. C. P. Castell and Mr. S. P. Dance exhibited fossil and recent examples from the British Museum collections, and the former gave an account of the development and structure of the shell of *Anomia*. Mr. Dance also exhibited a photograph, autograph and photostat copy of a letter of Hugh Cuming and a letter from Revett Sheppard to W. G. Maton; also Lamarck's *Recueil de Coquilles* (1841) and S. S. Haldeman's *Monograph of the freshwater univalve Mollusca of the United States* (1842). Mr. L. C. Prebble exhibited tropical marine and land shells, and Dr. H. E. Quick a copy of Dr. Vojen Ložek's *Klíč Československých Měkkýšů* (Bratislava, 1956).

763rd Meeting, held at the British Museum (Natural History), 19 April 1958

The President, the Rev. H. E. J. Biggs, in the chair.

Member Elected

Mrs. Leona Langdon Grantier, c/o Arabian American Oil Company, Box 1545, Dhahran, Saudi Arabia.

Communications

" An undescribed polymorphism in *Hygromia striolata* (C. Pfeiffer)," by A. J. Cain.

" Drought resistance in an African freshwater Bivalve," by S. P. Dance.

Exhibits

Special exhibits: Naticidae, *Mutela*, examples of which from the British Museum collections were shown by Mr. C. P. Castell and Mr. S. P. Dance. Living *Testacella scutulum* from Princes Risborough, Bucks, were exhibited by Mr. E. C. Badcock, and living *Testacella maugei* and *Ceciliodes acicula* from Swansea by Dr. H. E. Quick. The authors of the two papers exhibited relevant specimens.

764th Meeting, held at the British Museum (Natural History), 17 May 1958

The President, the Rev. H. E. J. Biggs, in the chair.

Members Elected

Istituto Italiano Idrobiologia, Verbania Pallanza, Italy.

Leslie Sarony-Frye, 11 Craneford Way, Twickenham, Middlesex.

Charles William Walker, 26 Greenhill Street, Bradford Moor, Bradford 3, Yorkshire.

Communications

" A short history of the known occurrences of *Helicella gigaxi* (L. Pfeiffer) in Ireland," by A. W. Stelfox.

" Molluscan mortality at Youghal, Co. Cork," by L. S. Atkins.

Exhibits

Special exhibits: Lucinidae, *Pupilla*. Recent or fossil examples were shown by Mr. C. P. Castell and Mr. S. P. Dance (from the British Museum collections) and by Mr. L. W. Stratton. Mr. Dance also exhibited the Museum's only specimen of *Thyrophorella thomensis* Greeff, showing the unique hinged " door ". Examples of *Pupinella* and *Strophocheilus maximus* were shown by Mr. T. Pain, and marine shells from Patagonia, South African Volutidae (including *Neptuneopsis gilchristi* Sowerby) and colour photographs of slugs by Mr. R. P. Scase.

ACCOUNTS FOR THE YEAR ENDING 31 DECEMBER 1957.

Income and Expenditure Account.

Dr.	£	s.	d.	£	s.	d.
To Annual Subscriptions—						
,, Paid in 1956	16	8	0			
,, For 1957	106	4	3			
,, Arrears	34	10	0	157	2	3
,, Sales				141	4	8
,, Donations				11	0	0
,, Transfer from Life Membership Fund				21	0	0
,, Dividends				28	0	0
,, Premium on Stock Conversion				2	0	0
				£360	6	11

Cr.	£	s.	d.	£	s.	d.
By Publication and Distribution—						
Vol. 24, part 6	98	3	2			
Author's reprints	11	4	3	109	7	5
Vol. 24, part 7	141	0	0	141	0	0
Authors' reprints						
,, Dispatch of parts				9	1	7
,, Printing and Stationery				7	1	5
,, Zoological Record				2	0	0
,, Binding Office copy of Journal				3	3	0
,, Officers' Expenses				7	9	9
,, Balance being excess of Income over Expenditure				81	3	9
				£360	6	11

Life Membership Fund.

	£	s.	d.
To Amount of Fund, 1 January 1957	569	14	0
,, Dividends and Interest	21	0	0
	£590	14	0

	£	s.	d.
By transfer to Income and Expenditure Account	21	0	0
,, Amount of Fund, 31 December 1957	569	14	0
	£590	14	0

Research and Reserve Fund.

	£	s.	d.		£	s.	d.
To Amount of Fund, 1 January 1957	420	0	5	By Amount of Fund, 31 December 1957	435	3	7
,, Dividends and Interest	15	3	2				
	£435	3	7		£435	3	7

BALANCE SHEET

Liabilities.				£	s.	d.
Annual Subscriptions in advance				6	18	4
Life Membership Fund				569	14	0
Research and Reserve Fund				435	3	7
Capital Stock				800	0	0
Balance from Income and Expenditure Account—						
As on 1st January 1957	400	6	5			
For 1957	81	3	9	481	10	2
				£2,293	6	1

Assets.	£	s.	d.	£	s.	d.
4% Funding Loan (cost)	350	0	0			
2½% Defence Bonds (cost)	200	0	0			
3½% War Loan (cost)	40	0	0			
3½% Defence Bonds (cost)	800	0	0	1,390	0	0
Cash at Bankers—						
National Provincial	332	9	3			
Post Office Savings	565	16	10			
Cash in hand	5	0	0	903	6	1
				£2,293	6	1

NOTE.—Assets in addition to those set out in the above Balance Sheet are stocks of unsold Publications and Subscriptions in arrears.

Examined and found correct.
S. P. DANCE,
M. MAITLAND HOWARD, } *Auditors.*
7 *February* 1958.

ALBERT E. SALISBURY,
Hon. Treasurer.
20 *January* 1958.

CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND

Subscription: £1 per annum. **Entrance fee,** 10s.

Meetings are held at the British Museum (Natural History), by permission of the Trustees, at 2.30 p.m., usually on the third Saturday of each month from October to May. Field Meetings are also held.

The Journal of Conchology is issued free to Members. Back numbers are obtainable from the Hon. Secretary, Mr. C. P. Castell, Department of Geology, British Museum (Natural History), Cromwell Road, London, S.W. 7, and from Mr. David Nutt, 156 High Holborn, W.C. 1.

Special Numbers: *Roebuck Memorial Number*, 1921 (Census of British land and freshwater Mollusca), 5s. *Boycott Memorial Number*, 1951 (Census of the distribution of British non-marine Mollusca), £1. *The British Marine Mollusca*, by R. Winckworth, 1932, 7s. 6d. All post free. Members receive a discount of 25 per cent.

Further information and nomination forms may be obtained from the Hon. Secretary.

Malacological Society of London

Hon. Sec.: MAJOR G. I. CRAWFORD, 18 East Drive, Carshalton, Surrey.

Subscription: Ordinary Members £1 5s. per annum or £25 for life; Corresponding Members (resident without the British Islands) £1 per annum or £20 for life.

Entrance for all, 10s. 6d.

Meetings are held in the apartments of the LINNEAN SOCIETY, BURLINGTON HOUSE, W. 1, on the *Second Friday* in each month from *October* to *June*.

Proceedings: Three numbers a year are free to all Members.

⁂ Back Numbers may be obtained on application to the Hon. Sec. Members receive a discount of 20%.

LAND MOLLUSCA OF NORTH AMERICA

(North of Mexico)

By

HENRY A. PILSBRY

Curator of Mollusks, Academy of Natural Sciences of Philadelphia.

The first comprehensive treatment of the subject in over fifty years. Many previously unpublished observations and descriptions of new genera and species. The 1,166 illustrations (more than 4,000 figures) include important drawings of soft anatomy. Printed on heavy coated paper with illustrations scattered conveniently through the text. The last part contains a catalogue of all species and subspecies treated. The four parts include 2,200 pages.

Vol. 1, Part 1.—The families Helicidae, Helicellidae, Helminthoglyptidae and Camaenidae. 599 pages, 377 illus. 1939. Price $8.00.

Vol. 1, Part 2.—The families Polygyridae and Sagdidae. 437 pages, 203 illus. 1940. Price $6.00. Vol. I complete, $13.00.

Vol. 2, Part 1.—The families Bulimulidae, Urocoptidae, Cerionidae, Achatinidae, Oleacinidae, Haplotrematidae and Zonitidae. 528 pages, 281 illus. 1946. Price $7.00.

Vol. 2, Part 2.—The families, Limacidae, Endodontidae, Arionidae, Philomycidae, Succineidae, Strobilopsidae Pupillidae, Valloniidae, Cionellidae, Carychiidae, Veronicellidae, Truncatellidae, Pomatiidae and Helicinidae. 640 pages, 304 illus. 1948. Price $8.00. Volume 2 complete, $14.00. Entire set, $25.00.

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BEING THE ORGAN OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

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Epsom College,
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CONTENTS.

PAGE
The Mollusca of some Cheshire marl-pits: a study in colonization—N. F. McMILLAN 299
Two new subspecies of *Jaminia* (*Euchondrus*) *continens* (Rosen) from Iran—L. FORCART 315
A monstrosity of *Cyprina islandica* (L.)—H. SCHLESCH . . 318
An undescribed polymorphism in *Hygromia striolata* (C. Pfeiffer)—A. J. CAIN 319
A Check-List of East African non-marine Mollusca—B. VERDCOURT 322
Netherlands Malacological Society 322
Two unusual snail colonies—L. W. STRATTON . . . 323
Saxicavella jeffreysi Winckworth at Plymouth—N. A. HOLME . 325
Obituary: E. W. Swanton 326
Latiaxis fritschi (von Martens) and *Fusus speratus* (Cossman)—K. H. BARNARD 327
Planorbis vortex (L.) with double aperture—T. E. CROWLEY . 327
Reviews 328
Caecum folini nom. nov.—B. S. KISCH 329
Proceedings: 18 October and 15 November 1958 . . . 329

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THE MOLLUSCA OF SOME CHESHIRE MARL-PITS: A STUDY IN COLONIZATION

By NORA F. MCMILLAN

(*Based on Presidential Address delivered at Annual Meeting*, 16 *February* 1957.)

INTRODUCTION

THIS work was begun as a survey of the freshwater Mollusca of a Cheshire district (Bromborough). Marl-pits, many now water-filled, form a characteristic feature of the Cheshire scene, and as the survey progressed it was realized that here was an example of freshwater molluscs colonizing new habitats on a large scale and over centuries, for marl has been dug in Cheshire from at least the thirteenth century until well into the nineteenth. Consequently the results obtained by the present survey throw some light upon the relative powers of dispersal possessed by the various species.

PREVIOUS WORK

James Wright Whitehead collected Mollusca around Bromborough about a hundred years ago (see Fisher and Jackson, 1936) but otherwise there appear to be no early records. The ecological reconnaissance of 60 Liverpool marl-pits mentioned by Elton and Miller (1954) was never published, and Massey's botanical work on Liverpool and Cheshire marl-pits is likewise unpublished, but may be seen in the Liverpool Reference Library.

Elsewhere in N.W. England Davies (1922) surveyed the Mollusca of the district west of Manchester, and Macan (1950) freshwater Mollusca in the Lake District. Boycott's classic studies (1919; 1930) on the freshwater Mollusca of Aldenham (Hertfordshire) have been my guide throughout.

DESCRIPTION OF THE AREA STUDIED

The area studied is irregularly shaped (see sketch-map), about 10 square miles of the Wirral peninsula, Cheshire. It is covered by the 6 inch O.S. map Cheshire Sheet 23 N.E. (now included in Sheet SJ 38 S.W., published 1954), and parts of the adjoining sheets 23 N.W., 13 S.E., and

22 S.E., comprising in addition to Bromborough, Poulton-cum-Spital and parts of Thornton Hough, Raby, Brimstage and Eastham. Throughout the present paper the area investigated is for convenience referred to as the Bromborough district. Thornton Hough, Raby and Brimstage are relatively rural and their marl-pits suffer much less from human interference than those around Bromborough. Bromborough, once a pleasant little sandstone village, is now part of the great Merseyside conurbation. Fortunately many of its marl-pits survive although their existence is precarious.

The geological background is similar throughout, being Trias overlaid with boulder clay ; the lack of lime is reflected in the poverty of the land-shell fauna. Deep gorges cut by the Dibbin stream and its tributaries combine to drain some 25 square miles of mid-Wirral and eventually enter the Mersey by the tidal creek of Bromborough Pool. This tidal portion has not been included in the survey : an account of its molluscan fauna has already been published (McMillan, 1948).

The only large bodies of water are the artificial Raby Mere (a disused mill-pond) and the lake at Thornton Hough. Neither is further considered. The former is afflicted by boating, ducks and swans, and the water is run off periodically. The latter is rather inaccessible, very shallow and only made during the present century.

METHODS

Work was begun in 1940 and continued to the end of 1957. Every watery habitat which seemed reasonably permanent was visited repeatedly and at different times of the year. On each occasion notes were made of the Mollusca taken by hand-scoop (no dredging was done), the plants, water-level, etc. *Every* marl-pit marked on the 6 inch O.S. map Cheshire Sheet 23 N.E. was visited and later many pits in adjoining areas were also kept under observation. While it is not claimed that every pit received identical attention, yet every one was examined several times yearly and over a period of several years. No quantitative work was undertaken, but nevertheless it is felt that a fairly representative picture of the molluscan fauna has been obtained. Altogether 172 pits have been studied. By the kindness of Dr. H. B. N. Hynes, the electric conductivity of the water in many of the pits was determined during 1956–1957.

DESCRIPTION OF THE HABITAT

Marl-pits were dug to obtain " marl " (usually boulder-clay) for agricultural purposes and are of all sizes up to an acre or more ; a very usual size for Wirral pits is about 40 yards by 30 yards, according to Massey. Their present depths range from nearly 40 feet (this is exceptional) but most are now between 6 and 16 feet in depth. Many are square or oblong with three steep sides and a sloping one where carts could go in to fetch the marl. Hence the area of " shore " available for snails is often small relative to the overall size of the pit ; this shallow marginal zone is important to Mollusca and ponds with vertical sides are unsatisfactory habitats. Another discouraging factor is that marl-pits are always stagnant. Pits occurring in woodland are usually floored with rotting leaves and as a rule contain neither plants nor snails.

Pits often occur in groups with narrow strips of land left between them and such odd pieces of land and the steep sides form refuges for plants. Hence many pits are fringed with trees, usually oaks, although ash, alder and hawthorn also occur. Willows are frequent and help materially the process of colonization by land-plants. Pits in grazed fields are habitually used as cattle-ponds and therefore tend to have the edges trampled down and a marshy area formed, which encourages land plants to spread further into the pit. Pits in arable fields are apt to be used as convenient dumping-places for all sorts of rubbish, such as potato haulms, etc. All these factors make it impossible to estimate the age of any pit by the stage of progress towards a marsh and eventually dry land which it has reached.

Regarding the age of individual pits it has been suggested that they date only from the general enclosure of common lands, but this does not appear to be the case in Cheshire, which was not much affected by the great wave of enclosure (1760–1820) and where marling has been practised for many centuries. As early as the fourteenth century reclamation of land from waste was invariably accompanied by marling, according to Leland, and Hewitt (1920) states that among the Forest Pleas preserved at Chester is one dated 1303, wherein the Abbot of St. Werburg's was charged, *inter alia*, with digging without permission marl-pits at Sutton, Bromborough, Eastham and Childer Thornton (all in Wirral).

Many of the pits, no doubt, do date from the time of the various enclosures when there would be an incentive to improve one's land by marling. This is evident from a series of estate maps which Mr. Roger Lancelyn Green has allowed me to examine ; these maps range from 1721 to the present time and cover a good deal of the area of my survey. No pits were marked on the 1721 map, nor on an enclosure map dated 1757. A later map of the " enclosed " area, dated 1793, has many pits shown on it and almost all have survived to the present day. On another estate map (of Bromborough, about 1731) many of the existing pits are marked, very many on the Tithe Map (1840) and all are on the 6 inch O.S. map Cheshire Sheet 23 N.E., ed. 1 (1882).

MOLLUSCA OCCURRING IN THE MARL-PITS OF THE BROMBOROUGH DISTRICT

In the Table are set out the species obtained in every pit over the period of the survey, the electric conductivity of the water where determined and in col. 2 the response to the drought of 1949, classified according to Boycott (1930, p. 8).

The species of *Pisidium* obtained are not specified as, although it had been intended to list *Pisidium* species in the same detail as other species, this proved impracticable, because as a rule one sample only was taken from each pit and it was later realized that this was quite inadequate. From one pit (No. 47) samples were obtained from several loci and four species found (*casertanum*, *milium*, *subtruncatum* and *nitidum*). Obviously one

Pit Number	Drying Class	Electric conductivity µmho	*P. jenkinsi*	*L. truncatula*	*L. palustris*	*L. stagnalis*	*L. auricularia*	*L. peregra*	*A. hypnorum*	*P. fontinalis*	*P. corneus*	*P. carinatus*	*P. planorbis*	*P. vortex*	*P. albus*	*P. crista*	*S. complanata*	*Acroloxus*	*S. corneum*	*S. lacustre*	*Pisidium* spp.	NOTES
1	A	187					×	×			×								×			Filled in, 1957.
2	A	336						×						×	×		×	×	×		×	
3	A	284						×							×	×	×		×	×	×	
4	—	—						×			×											Filled in, 1949.
5	A	173					×	×			×				×		×		×		×	
6	—	237	×				×	×			×				×		×		×	×	×	Small constant outflow. Partly fed by a spring.
7	B	722						×							×	×	×		×	×	×	
8	A	—						×						×			×		×		×	Filled in, 1951.
9	A	—	×			×	×									×	×		×	×	×	Filled in, 1951.
10	B	—						×							×							Filled in, 1952.
13	B	219						×							×		×	×	×	×	×	
16	—	—						×							×	×						
17	C	217																			×	
18	D	638		×	×				×												×	
19	B	682																			×	
20	—	—																	×			Filled in, 1947.
21	— }	255						×													×	Pits joined.
22	— }																					
23	C	345																			×	
24	—	509																			×	
25	D	364																			×	
28	—	214													×		×				×	
29	A	—			×			×		×					×				×		×	
31	—	295				×										×		×	×		×	
32	B	172				×		×							×				×		×	
34	A	345				×		×			×				×		×	×	×			
35	—	—				×		×							×			×	×			Filled in, 1947.
36	B	171						×							×		×		×		×	
37	B	237						×		×					×				×			
38	A	465				×	×				×							×	×			
39	A	250						×							×			×	×		×	
40	D	538						×													×	
41	B	376				×		×							×		×				×	
42	B	413						×							×		×	×	×		×	
45	—	—		×																		
47	A	—				×	×	×			×		×		×				×	×	×	Filled in, 1956.
48	A	132					×	×						×					×		×	
49	—	—						×							×						×	
53	B	460													×				×		×	
54	A	362					×	×				×							×			
55	A	—						×							×		×	×	×		×	
56	A	—				×	×	×														Filled in, 1952.
57	A	—						×							×		×				×	
58	—	273			×			×							×						×	
59	B	262				×		×			×				×				×		×	
61	—	214			×	×		×						×	×				×		×	
63	C	140				×		×									×	×				
64	B	237						×													×	
65	—	438						×										×				
71	—	368				×		×			×						×			×	×	
72	—	—					×	×			×			×					×			Filled in, 1948.
73	E	359															×		×			
74	B	330						×									×		×		×	
75	B	349						×									×		×		×	
76	A	352						×			×			×	×		×	×	×		×	
77	B	338																	×		×	
78	D	295			×			×											×			
79	C	356						×										×	×		×	
83	A	205				×		×							×	×	×	×	×			
84	A	509				×		×			×				×			×	×	×	×	
85	—	395																			×	
86	A	121						×			×				×				×			
90	A	—						×							×				×		×	
92	—	438																	×		×	
93	A	490			×			×														
94	—	—						×											×		×	Filled in, 1949.
95	—	328			×	×		×		×	×				×		×		×		×	

Pit Number	Drying Class	Electric conductivity	*P. jenkinsi*	*L. truncatula*	*L. palustris*	*L. stagnalis*	*L. auricularia*	*L. peregra*	*A. hypnorum*	*P. fontinalis*	*P. corneus*	*P. carinatus*	*P. planorbis*	*P. vortex*	*P. albus*	*P. crista*	*S. complanata*	*Acroloxus*	*S. corneum*	*S. lacustre*	*Pisidium* spp.	NOTES
		μmho																				
96	—	—			×					×												Filled, in, 1953.
97	A	—						×							×				×			
98	A	—						×							×	×					×	
99	—	366				×	×	?											×			
101	—	—						×		×					×						×	Filled in, 1946.
102 103	A	—				×	×	×		×					×				×		×	Filled in, 1956.
104	—	—						×							×							Filled in, 1950.
105	—	348													×				×			
105a	—	—						×							×		×		×		×	
109	A	—						×														
110	—	516						×													×	
112	A	259				×	×	×							×				×	×	×	
115	A	—						×						×	×					×	×	
116	A	—												×							×	
117	A	—													×						×	
118	A	—						×		×					×			×			×	
120	—	—						×						×	×				×		×	
121	—	—						×										×			×	
125	—	—						×		×											×	
128	B	194						×							×		×		×		×	
129	C	336																			×	
130	—	248																	×		×	
132	—	—				×		×										×	×			
133	—	465						×				×			×			×	×			
136	—	—																			×	
138	B	205														×						
141	B	—						×										×		×	×	Filled in, 1954.
142	—	465				×		×							×		×	×	×		×	
143	—	284						×										×			×	Nos. 143 and 144 coalesce in wet weather.
144	—	284						×													×	
145	—	465				×		×							×			×	×		×	
146	—	—						×														Filled in, 1949.
147	A	237				×		×											×			
148	A	216						×		×					×		×		×		×	
149	A	294						×		×	×				×			×	×		×	Also *Anodonta* sp.
152	—	388	×					×							×				×	×	×	
157	—	387														×					×	
158	B	478					×	×							×		×	×	×	×	×	
159	A	348						×											×		×	
163	A	—						×							×				×			
164	C	287						×						×			×		×	×		
165	D	219																			×	
166c	A	—			×			×							×			×	×			
166D	A	—																		×	×	
170	A	—													×						×	
171	A	310													×							
172	B	251				×		×							×				×		×	
177	—	—																		×	×	
178	—	563			×			×									×		×		×	
179	A	—								×							×		×			
180	—	—						×														
181	—	297						×											×		×	
183	—	142				×																
190	—	310						×						×	×				×		×	
193	—	—			×																	

mho = the unit of electrical conductance (reciprocal of ohm) ; μmho (micro-mho) = one-millionth of a mho.

sample will not give a true picture of the *Pisidium*-fauna of a pit and therefore *Pisidium* spp. have been excluded from the calculations on p. 305.

Specimens so far determined are listed below. All were first named by the author and then checked by Mr. Stelfox to whom I am most grateful. It is hoped to publish a fuller account later.

Eighty-two pits yielded *Pisidium* spp. and 26 produced the following species:

Pisidium casertanum (Poli). Pits 5 and 47.
P. subtruncatum Malm. In 11 pits.
P. nitidum Jenyns. In 8 pits.
P. milium Held. In 13 pits.
P. hibernicum Westerlund. Pit 29.
P. pulchellum Jenyns. In 29 & 76.
P. henslowanum (Sheppard). Single valve in pit 125; fine specimens abundant in 166D.

THE DISTRIBUTION OF THE VARIOUS SPECIES IN THE MARL-PITS

Of 172 pits examined 121 held Mollusca of some sort, distributed thus:

Lymnaea peregra (Müller)	in 85 pits.
Sphaerium corneum (L.)	in 71 pits.
Planorbis albus Müller	in 57 pits.
Segmentina complanata (L.)	in 31 pits.
Acroloxus lacustris (L.)	in 26 pits.
Lymnaea stagnalis (L.)	in 25 pits.
Planorbarius corneus (L.)	in 16 pits.
Sphaerium lacustre (Müller)	in 16 pits.
Lymnaea auricularia (L.)	in 14 pits.
Planorbis vortex (L.)	in 11 pits.
Lymnaea palustris (Müller)	in 11 pits.
Physa fontinalis (L.)	in 10 pits.
Planorbis crista (L.)	in 9 pits.
Potamopyrgus jenkinsi (Smith)	in 3 pits.
Lymnaea truncatula (Müller)	in 2 pits.
Planorbis carinatus Müller	in 2 pits.
P. planorbis (L.)	in 1 pit (1 dead shell).
Aplexa hypnorum (L.)	in 1 pit (1 young spec.).

A further nine pits held *Pisidium* spp. only.

Anodonta spp. were introduced into many pits about 1912 and still flourish. Nearly all the pits hold fish of some sort and glochidia on fish moved from pit to pit by anglers may have distributed mussels more widely.

Forty-two pits yielded no Mollusca, ten because they were heavily stocked with ducks or geese; six more were foul with rubbish, and one was hopelessly fouled by some effluent. The remaining twenty-five snailless pits are mostly heavily shaded. Possibly they contain snails but I have been unable to find any.

THE MOLLUSCA OF PONDS WHICH ARE NOT MARL-PITS

For comparison with marl-pits details are given below of other ponds, as well as a bomb-hole and a pond (No. 107) which may have been the fish-stew of a manor-house (now Bromborough Court House) of the Abbey of St. Werburg.

Number	Drying class	Electricity Conductivity	*P. jenkinsi*	*L. truncatula*	*L. palustris*	*L. stagnalis*	*L. auricularia*	*L. peregra*	*P. corneus*	*P. planorbis*	*P. vortex*	*P. albus*	*P. crista*	*S. complanata*	*A. lacustris*	*S. corneum*	*S. lacustre*	*Pisidium* spp.	NOTES
		µmho																	
14	D	—			×			×	×				×	×		×	×	×	
43	B	287					×	×				×				×	×	×	Cattle-pond.
108	E	304						×										×	Cattle-pond.
156	F	—																×	Small pool in glen.
46	—	645	×															×	Woodland pond.
191	—	—						×										×	Woodland pond.
192	—	388			×			×								×		×	Woodland pond.
106	D	230																×	
107	E	465																×	? Fish-stew.
113	—	1,078					×	×		×		×						×	Large ornamental water. Filled in 1957.
15	—	—					×						×						Fair-sized concreted ornamental pond. Filled, 1948.
127	E	206				×										×		×	Bomb-hole made 1941.
	—	—	×			×	×	×				×				×	×	×	Old brick-pit, now filled.
	—	—	×			×		×					×				×	×	Shallow trenches close to brick-pit

The following species of *Pisidium* have been determined from the above loci : *P. casertanum* in No. 156 ; *P. milium* in No. 14 ; *P. subtruncatum* in Nos. 43, 113 & 127 ; *P. obtusale* in No. 106.

The Resistance of Marl-pits to Drought

A factor affecting the distribution of snails is the response of the habitat to drought ; a pond which dries up frequently is a much less suitable habitat for most snails than one little affected. With this in view many of the marl-pits and other ponds of the district were examined during the drought of 1949. Seventy-three pits containing snails and ten without any were taken at random and the results noted in Column 2 of Table I.

Direct comparison between the different classes of pits according to their liability to dry up is difficult, as the numbers in each class vary a good deal. In the following table *Anodonta* and *Pisidium* spp. are not included.

Drying class (Boycott, 1930, p. 8).	*No. of pits with snails.*	*Total No. of species.*	*Species of snails per pit (average).*	*No. of pits without snails.*
A. Not much shrunk . . .	41	16	4·1	4
B. Considerably shrunk, but open water present.	20	10	3·4	—
C. No open water ; mushy . .	6	7	1·8	1
D. Dry : bottom soft : humus present.	5	5	1·4	3
E. Dry : bottom hard : no humus	1	2	2	1
F. As E and also drying in an average summer.	—	—	—	1

Physa fontinalis occurs only in pits of Classes A and B ; *Planorbis vortex* only in Class A, except for one occurrence in a C pit. *Potamopyrgus jenkinsi* lives in one A pit and in two more about which I have no data. The larger planorbids (*P. corneus* and *P. carinatus*) and *Lymnaea auricularia* are confined to Class A pits.

THE "HARDNESS" OF THE WATER OF THE MARL-PITS

Marl was dug in order to obtain lime in some form or other and therefore the water accumulated in marl-pits is always fairly hard. It was not possible to obtain water-samples from every pit in the area studied, but 83 were sampled (6 without snails). The electric conductivity of the water was determined as, in the absence of contaminants such as salt, this gives some indication of the hardness of the water. The results obtained are given in Column 3 of Table I.

Six samples from different parts of the Dibbin gave conductivity μmho 385 to 393 and Ca mg/litre 78–81; two small tributaries gave conductivity μmho 312 and 540 (Ca mg/litre 78 and 149).

As all the pits are stagnant (except No. 6) there is no possibility of the hardness being influenced by an inflowing stream. No. 6 is fed partly by a spring and has a small but constant outflow; its conductivity (μmho 237) is nothing abnormal.

Considering the conductivity figures for all the pits sampled, one finds that they range from 121 (pit 86) to 722 (pit 7); nine below 200, three above 600 and the remaining 71 between 200 and 600. Boycott (1936, p. 149) found 20 mg/litre to be, generally speaking, the critical degree of hardness for snails and as 120–150 μmho on the electric conductivity scale equals very roughly this figure, the marl-pits may be said to have water hard enough for any freshwater snail.

The pit with the highest conductivity (No. 7) and the three with the lowest (Nos. 46, 86, 183) were then re-sampled and further investigated with the following results. For these I am indebted to Mr. F. J. H. Mackereth of the Freshwater Biological Association.

ANALYTICAL RESULTS

me.l. = milli equivalents per litre. p.p.m. = parts per million.

Sample and date	Pit 7 23.xi.1957		Pit 48 1.xii.1957		Pit 86 23.xi.1957		Pit 183 30.xi.1957	
	me.l.	p.p.m.	me.l.	p.p.m.	me.l.	p.p.m.	me.l.	p.p.m.
Total ions	14·20		1·360		1·200		1·480	
Cations								
Calcium (Ca^{++})	9·80	196·0	0·595	11·9	0·500	10·0	0·643	12·85
Magnesium (Mg^{++})	2·18	26·5	·256	3·12	·246	3·00	·438	5·33
Sodium (Na^{+})	1·87	43·0	·426	9·80	·348	8·00	·356	8·20
Potassium (K^{+})	0·44	17·0	·105	4·1	·085	3·3	·157	6·1
Sum of cations	14·29		1·382		1·179		1·594	
Anions								
Alkalinity (HCO$_3$′)	7·80		0·490		0·330		0·530	
as CaCO$_3$		390·0		24·5		16·5		26·5
Chloride (Cl′)	2·40	85·2	·508	18·2	·518	18·4	·528	18·8
Sulphate (SO$_4$″)	3·97	190·5	·352	16·9	·344	16·5	·414	19·9
Nitrate Nitrogen (NO$_3$′N)	·034	0·47	·010	0·136	·008	0·115	·008	0·115

FLUCTUATIONS OF THE MOLLUSCAN FAUNA FROM YEAR TO YEAR

The molluscan fauna of any one pit appears to be fairly stable and I have encountered nothing like the comings and goings found by Boycott in his Aldenham ponds. Probably the greater depth and volume of water in the marl-pits accounts for the greater constancy of species. During droughts of 1949 and 1955 some of the smaller pits were reduced to mush (Boycott's drying Class C and even D) ; larger pits shrank appreciably and in many cases have not regained their former water-level, but the molluscan fauna does not seem to have been materially affected in either case. Quantitatively the fauna may have been affected, but in no case have I found drought to be followed by the disappearance of a species.

Elton (1933) has pointed out that an ecological survey based on the results of ten years' collecting might give a misleading picture of the total number of species ever present in one year. He asks pertinently whether the species composition varies not only spatially but also from year to year in one place. In the Bromborough pits changes in the molluscan fauna from year to year are rare and usually clearly due to extraneous causes, e.g. drastic cleaning out, ducks taken from or put into a pit, felling of trees round edges (this acts in two opposing ways : by allowing more light to reach the water and thereby encouraging both plants and snails ; and by the fouling effect of decaying brushwood as such debris is generally dumped into the nearest pit).

In one large pit (No. 5—Woodslee "lake") the fauna has remained the same over the fifteen years it has been under observation, although the pit is becoming shallower and vegetation increasing. Mallard and waterhen frequent it. The nearest pit (No. 6) is distant only about 50 feet and contains *Potamopyrgus jenkinsi* and *Sphaerium lacustre*, neither of which occurs in No. 5.[1] Another pit (No. 7), distant about 300 yards from No. 5, holds *Planorbis crista* and *Sphaerium lacustre*, both missing from No. 5. It seems strange that species apparently so suitable for transport as *P. jenkinsi* (parthenogenetic) and *P. crista* (small, thin, clings very firmly) have not reached pit 5 by some means.

In only one pit has the fauna varied considerably and inexplicably. Pit 1 was about a third of an acre in extent, partly shaded and with a normal flora. Until 1947 this pit was little altered, but then the trees round it were cut down and the brushwood thrown into the water. Builder's rubbish was tipped from 1949 onwards. The variations in the fauna are tabulated below :

1940.	*L. peregra, L. auricularia, P. corneus, S. corneum*—all frequent.
1942.	*P. corneus, S. corneum.* No *Lymnaea* spp.
1943.	*S. corneum* only.
1947.	*S. corneum.* No gastropods.
1948–1949.	*P. corneus, S. corneum.* No *Lymnaea* spp.
1950.	*P. corneus, L. peregra,* both fairly plentiful.
1953.	No snails. Pit partly filled in and foul.

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[1] Pit 6 containing *P. jenkinsi* is partly fed by a spring and has a small but constant outflow. It is not therefore stagnant and perhaps this is why *P. jenkinsi* lives in it, and not in No. 5. But *P. jenkinsi* has lived for a good many years in two other pits which so far as I know are not spring-fed.

1954. *L. peregra*, not common. No other snails.
1955. *L. auricularia*, abundant. No other snails.
1956. *L. auricularia* in vast numbers. No other snails.
1957. Pit filled in.

The *L. auricularia* is the usual *acuta* form prevalent in the district, and living specimens have been confirmed as that species by Dr. Quick.

The disappearance of *Lymnaea* spp. before 1947 when conditions seemed normal is inexplicable. Repeated searches were made from 1942 onwards but none was found until 1950 and 1955. The floating form of the hepatic *Riccia fluitans* L. was taken in the pit for the first time in March 1951 and if a scrap of *Riccia* was transported on a bird's foot, it seems possible for a very young *Lymnaea* to be also carried clinging to the plant.

Sources of the Marl-pit Mollusca

The practice of marling dates from at least the thirteenth century and many of the Bromborough marl-pits are shown on an estate map of 1731, while some may be older. It must surely take very many years for a deep marl-pit (many in their present state are 16 feet and one was 40 feet in depth) to fill up and return to dry land by the natural process of recolonization by land-plants.

When the first marl-pits were dug the country must have presented a very different appearance from that to which we are accustomed. Beazley (1915, page v) states there was formerly heath at Bromborough, but Wilcox (1933) shows (on her map B) that evidence drawn from early literature indicates that the survey area was then mostly woodland, no doubt dense oak forest in this region of heavy clay. What natural pools existed would be in woodland and contain few if any snails. In the valleys fallen trees would obstruct the streams and cause marshy areas. The Dibbin would be clean and could support a richer molluscan fauna. There are now no natural lakes or meres in Wirral, but there were in earlier times (see Rideout 1925, pp. 133–4). There is a persistent tradition that within historic times the Dibbin expanded into a wide tidal mere or pool below Poulton Lancelyn. The Cheshire historian Ormerod (1882) first drew attention to the names of the fields beside the Dibbin below Poulton, viz. Marfords, and suggested that this was a corruption of Mere-ford. Rideout (1923, p. 118) says cautiously: "From our exceedingly scanty historic evidence it seems probable that the tidal influence was extended as far up the stream as Poulton, and to it we may perhaps attribute some of the widening of the valley, but until further geological evidence is forthcoming it would be unwise to speculate upon the topic." And there the matter rests for the present.[1] The species now living in the Dibbin and its tributaries are *Potamopyrgus jenkinsi*, *Lymnaea palustris*, *L. peregra*, *Planorbis vortex*, *Ancylus fluviatilis*, *Acroloxus lacustris* (in one place only) and *Pisidium* spp. The floods of February 1948 also brought down some dead but fresh *Sphaerium corneum* from an unknown source.

Seven springs and the Petrifying "Well" (a highly calcareous spring) only hold between them *Potamopyrgus jenkinsi*, *Lymnaea truncatula*, *Aplexa hypnorum*, *Pisidium personatum* and *P. casertanum*.

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[1] Excavations for the new main sewer which is to be laid through this part of the Dibbin valley may confirm or disprove the above theory.

Shallow grassy hollows containing pools of varying degrees of permanence produce *Lymnaea truncatula*, *L. palustris*, *L. peregra*, *Aplexa hypnorum* and *Planorbis leucostoma*. For an account of one of these " temporary " ponds see McMillan (1947).

Boycott (1936, p. 163) lists 13 species as characteristic of large bodies of water which he defines as " good-sized rivers, lakes, canals, and ponds of ¼ acre and upwards ", but of these 13 species the Bromborough pits yield only one (*Lymnaea auricularia*), although two more (*Anodonta* spp.) have been introduced and done well. Five further species are given as having the same habit but not so markedly, and of these Bromborough has only two (*Lymnaea stagnalis* and *Planorbis corneus*).

One natural mere would therefore in all probability have been sufficient, together with the species already available in the Dibbin and its tributaries, to stock our hypothetical first marl-pit. T. B. Hall (1839, p. 89, footnote) remarks that marl-pits are quickly colonized by plants " within a year ", and adds " these pits also contain an abundance of fresh-water shells, of the Genera *Physa*, *Planorbis*, *Succinea*, *Cyclas*, *Lymnaea*, etc.". His observations are valuable because they were made when marl was still being dug.

As marl-pits were naturally not dug where they would be liable to flooding by a stream it follows that snails had to reach the new habitats provided by the marl-pits overland, not by any watery route.

RATE OF COLONIZATION

In the marl-pits a state of relative equilibrium in the molluscan fauna appears to have been reached, except where physical conditions have been violently disturbed as in the examples already quoted (p. 307). This equilibrium presupposes a considerable age, during which period successive colonists have had time to settle down and the less suitable to be eliminated. In this connection the sequence of events in two Bromborough ponds (not marl-pits) is suggestive.

No. 43 is a shallow cattle-pond, between 25 and 50 years old, stagnant, usually muddy and much trampled. It is about 150 yards distant from three typical marl-pits (Nos. 40, 41 and 42). The history of No. 43 is, briefly, as follows :

1944–1946. Very muddy. No plants. No snails.
1947. Little *Potamogeton natans*. *L. peregra*, a few; *S. lacustre*, very abundant.
1948–1949. Some *Callitriche* sp., *Potamogeton* more plentiful. *L. peregra*, abundant ; *P. albus*, a few ; *S. lacustre*, much less frequent than in 1947.
1950. *P. albus*, a few; *S. lacustre*, not frequent; *S. corneum*, one, living; *Pisidium* sp.
1951. *L. auricularia*, frequent ; *L. peregra*, much less abundant. *S. lacustre*, a few.
1952. As 1951, but *S. lacustre* apparently absent.
1953. As 1951. One valve of *S. lacustre*.
1954. No observations.
1955. *L. peregra*, *L. auricularia*, *P. albus*, *S. corneum*, all abundant ; *Pisidium subtruncatum*, a few ; no *S. lacustre*.

The replacement of *S. lacustre* by *S. corneum* is noteworthy.

The succession of species in this pond is clear, but one would have expected it to have been colonized from one or other of the three nearest marl-pits, although even in the wettest weather there is no watery communication between the pits and the cattle-pond, nor between one pit and another. Yet the cattle-pond has contained two species (*Lymnaea auricularia* and *Sphaerium lacustre*) which do not occur in any of the three marl-pits and for which the nearest habitats are a mile and 1,100 yards distant respectively.

The colonization of a small bomb-crater dating from the winter of 1940–1941 is also of interest as it is sited at the top of a gentle rise and above all the neighbouring watery habitats. When first examined (in 1948) only *Lymnaea stagnalis* was present, specimens up to 35 mm. high being abundant. In 1949 the crater went dry, but in 1950 *L. stagnalis* was still abundant, no other species being present. *Sphaerium corneum* was found fairly plentifully in 1951, and in 1952 *Pisidium subtruncatum* joined the fauna. No further species were taken until October 1955, when a single living *Potamopyrgus jenkinsi* was collected. Since that date no more *P. jenkinsi* have been found nor any additional species.

The nearest source of snails is a grassy depression which holds *Lymnaea truncatula*, yet *L. stagnalis*, *S. corneum* and *P. subtruncatum* all reached the crater from further afield and necessarily from a lower level. The possibility of cattle or horses transporting small snails in mud or wisps of weed on their hooves from another pond seems most unlikely, as the only other pond in the field is permanently foul and snailless, and while it is presumably possible there does not seem to be any record of such transport having been observed.

NOTES ON THE " MARL-PIT " SPECIES OF MOLLUSCA IN THE BROMBOROUGH DISTRICT

Lymnaea peregra (Müller). The most widely-distributed species, occurring in the streams, cattle-ponds, " temporary " ponds and pits. In the larger pits *ovata* Draparnaud is the usual form.

Sphaerium corneum (L.). Common in marl-pits, but apparently absent elsewhere, except for fresh shells in Dibbin flood-debris once, source unknown. In wet weather migration overland may be possible, for Mr. Stelfox found two large specimens under a stone in Belvoir Park, Belfast, ¼ mile from water, and one was alive.

Planorbis albus Müller and *Segmentina complanata* (L.). Both fairly common in marl-pits, usually with several other species.

Acroloxus lacustris (L.). The only " natural " habitat is a very limited part of the stream-system, where *A. lacustris* lives in slack water at the side with *Ancylus fluviatilis* occupying the middle of the stream, and it is difficult to see how transport to fresh loci is effected.

Lymnaea stagnalis (L.). Transport is apparently easy, as this species was the first to colonize an isolated bomb-crater (see p. 310). It appeared newly in pit 41 in 1955 and has established itself there, and in 1949 pit 112 yielded one young example as an addition to its fauna, but no more have been taken. In 1956 it was introduced experimentally into a pit (No. 5) from which it was certainly absent previously, and two years later seems to be thoroughly established there.

L. stagnalis does not grow very large in the pits; the largest were those of pit 56 which were up to 50 mm. high. In 1945 pit 59 held abundant breeding *L. stagnalis*, none higher than 25 mm.

Sphaerium lacustre (Müller). Strangely rare, and not confined to the poorer pits. *S. corneum* and *S. lacustre* occur together in 11 pits and in some cases apparently live mixed together. *S. lacustre* was an early colonist of a cattle-pond (see p. 309), but was later replaced by *S. corneum*. The form *ryckholti* Normand, which is separated as a species by some Continental authors, was noted in the following pits :—

No. 3. One example, 15.viii.1949. Associated with typical *lacustre*.
No. 9. One example, 15.vi.1949. Also associated with typical *lacustre*.
No. 152. One example of an extreme form, 5.vi.1949. With typical *lacustre*.
No. 166D. Fine examples abundant, 21.viii.1949. No typical *lacustre*.
No. 84. Abundant but small, 12.v.1953. No typical *lacustre*.

Planorbarius corneus (L.). Widely but thinly distributed in the pits. Twice the species has appeared in well-worked loci (Nos. 6 and 14), where it is under suspicion of introduction (one pit was in the garden of a zoologist's house and the other locus beside a much-used path). The occurrence of *P. corneus* anywhere in Wirral is strongly suspect; it is not mentioned by Byerley (1854), Whitehead (see Fisher and Jackson, 1936) nor Higgins (1891), and Oldham (1908) did not consider it native in Cheshire (see also McMillan, 1947a).

Lymnaea auricularia (L.). The 14 pits in which this species lives are all " good " ones, little shaded and of fair size and depth. It usually occurs with several other species; its peculiar behaviour in one pit (No. 1) has already been described (see pp. 307–8). Only the form *acuta* Jeffreys occurs in the marl-pits, typical *auricularia* being absent from the district. An extreme form used to live in a large ornamental water (No. 113) (see McMillan, 1956).

Planorbis vortex (L.). Lives in one small part of the stream-system and therefore could presumably reach marl-pits in the area. Its occurrence in the stagnant marl-pits is unusual, as it is generally associated with moving water. *P. leucostoma* (Millet), which is more characteristic of stagnant water, is absent from the pits and very rare in the survey area, living only in one " temporary " pond.

Lymnaea palustris (Müller). Widely but thinly distributed, living in some of the streams, a spring, " temporary " ponds and in both good and poor pits. In one large pit which had almost reached the marsh stage of revegetation *L. palustris* was the only snail present. It appears to resist desiccation better than *L. peregra*, surviving in " temporary " ponds when *L. peregra* is killed off. Considering its apparent adaptability, it is strange that it is not more frequent.

Physa fontinalis (L.). This species, normally characteristic of running water, has no Bromborough loci except ten marl-pits. The nearest natural habitat for *P. fontinalis* now is the Rivacre Brook in the next drainage area, several miles distant.

Planorbis crista (L.). Oddly rare. The nine recorded occurrences are each for one or two specimens only, except pit 16 in which the species was abundant. Otherwise the only place where it has been taken in any numbers was a shallow moss-choked trench at New Ferry brickworks, about a mile from the nearest pit, where, incidentally, *P. crista* lives. If it is transported as easily as its small size and thinness suggest it ought to be, then it should be much more frequent about Bromborough than it is.

Potamopyrgus jenkinsi (Smith). The three marl-pits holding *P. jenkinsi* are :—(*a*) A large good pit partly fed by a spring, with seven other species plus *Pisidium* spp. ; *P. jenkinsi* has persisted here for ten years, but lives only in a small area around the spring. (*b*) A small poor pit, heavily shaded, accompanied by four other species and *Pisidium* spp. ; *P. jenkinsi* is not abundant but has persisted for eight years to date. (*c*) A large deep pit with seven other species ; *P. jenkinsi* rare, but persisted for four years until the pit was filled in. In 1957 *P. jenkinsi* was found abundantly in a small woodland pond (No. 46) accompanied only by *Pisidium* sp.

Elsewhere in Bromborough *P. jenkinsi* lives sparingly in part of the Dibbin and in some of the springs. The Dibbin and locus (*a*) had carinated as well as smooth-shelled specimens ; all the other loci had only smooth-shelled examples.

Lymnaea truncatula (Müller). Two occurrences in the marshy margins of two pits, and not since refound. These records seem to represent attempted and unsuccessful colonizations.

Planorbis carinatus Müller. Abundant, 1957, in pit 54 in which it had not previously been seen ; one living specimen and a shell from pit 133 in 1950 and not again taken there. These two records are puzzling, as the species is otherwise absent from the area surveyed. The specimens all belong to var. *dubia* Hartmann.

Planorbis planorbis (L.). Lived in one large habitat (No. 113), where introduction of the snails either with plants or fish (both introduced from time to time) seems probable. The other record is of a single shell in pit 47 which occasionally received water from No. 113. Pit 47 was a very good one and it seems strange that *P. planorbis* had not established itself there. A special search was made for *P. planorbis* when pit 47 was drained but none was found.

Aplexa hypnorum (L.). A single young specimen in the marshy edge of pit 18, and not subsequently refound. The species lives a few hundred yards away, in a ditch at the foot of the slope, the pit being at the top.

Comparison with the Mollusca of Marl-pits in Other Areas

Though much collecting has been done in marl-pits in many places only very seldom have sufficient details been given to enable comparisons to be made. Byerley (1854) records from Wirral pits half a dozen species and remarks how frequently *Bithynia tentaculata* occurs. The same species lives in marl-pits near Manchester, and used to live in pits near Sissinghurst, Kent, with *B. leachii*, *Anodonta cygnea* and *Unio pictorum* (Boycott, 1936). Milne and Oldham (1894) list 17 species (2 of them introduced) from Hampson's Pit (a marl-pit) at Baguley, Cheshire, and Britten and Williams (1934) found 11 species in two marl-pits at Pulford, near Chester. Standen (1887) records 23 species from the pits round Manchester, but two of these were introduced and two more are almost certainly misidentifications (*Planorbis lineatus* and *P. glaber*).

Putting together all these records we get 31 species from marl-pits. Deducting the two introduced species (*Viviparus* spp.) and the two probable errors, as well as the 4 *Pisidium* species, a total of 23 species remains. Of this number Bromborough pits yield 18 species (list on p. 304) as well as *Potamopyrgus jenkinsi* and *Anodonta anatina*. The species lacking from the Bromborough pits are :—

Valvata cristata Müller.	Recorded by Britten & Williams.
Bithynia tentaculata (L.).	Recorded by everyone from Byerley onwards.
B. leachii (Sheppard).	Recorded by Boycott.
Lymnaea glabra (Müller).	Recorded by Milne & Oldham ; Standen.
Unio pictorum (L.).	Recorded by Boycott.

Of the above list *L. glabra* has been recorded from the survey area " in a pond between Eastham and Willaston " (Byerley, 1854) but the species has not been refound. *V. cristata* has occurred once, when shells were found abundantly in an iron cattle-trough at Thornton Hough, together with shells of *Lymnaea truncatula*, *Planorbis vortex*, *Pisidium personatum* and one *Planorbis albus*. Living *L. truncatula* and *P. personatum* were present. *V. cristata* has not been found living in the Bromborough area. *Bithynia tentaculata*, *B. leachii* and *Unio pictorum* are absent from the survey area.

Marl-pits, being relatively large and deep habitats with hard water, are suitable habitats for very many species of fresh-water molluscs. Even species usually associated with running water, such as *Physa fontinalis*, *Planorbis vortex* and *Bithynia* spp. live in some, and *Viviparus* spp. when introduced do well. It seems therefore that theoretically hardly any species are debarred from living in marl-pits, and the paucity of species in the Bromborough pits is due to the poor selection of species available to colonize the first marl-pits.

SUMMARY

The freshwater molluscan fauna of 172 marl-pits in the Bromborough district of the Wirral peninsula, Cheshire, has been surveyed from 1940 to 1957 and found to comprise 27 species. Four more species live in the district but do not occur in marl-pits. The origin of the marl-pit molluscan fauna is discussed, and compared with that of marl-pits elsewhere. It is suggested that the poverty of the fauna of the Bromborough marl-pits is due to lack of sources from which the marl-pits could be colonized by Mollusca and not to any other factor.

POSTSCRIPT

The Mollusca collected during the survey will eventually be placed in the Liverpool Public Museums, together with the relevant 6 in. O.S. maps with marl-pits numbered to correspond with the survey (Table I).

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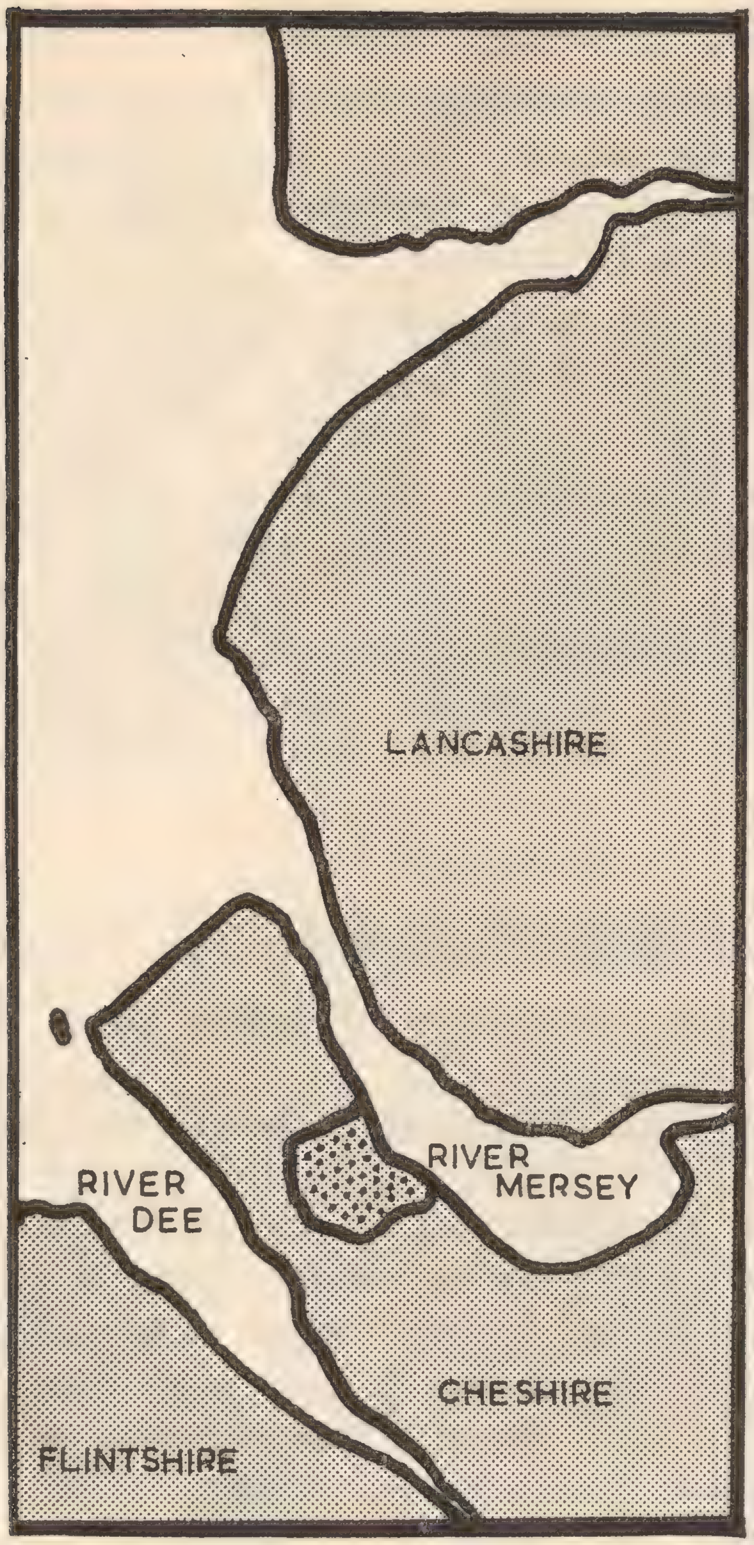

Map indicating the position of the Bromborough district (stippled).

TWO NEW SUBSPECIES OF *JAMINIA* (*EUCHONDRUS*) *CONTINENS* (ROSEN) FROM IRAN.

By Lothar Forcart
Museum of Natural History, Basle (Switzerland)

(*Read before the Society*, 15 *November* 1958)

Rosen (1892, 125) described from the Kopet Dağ on the frontier region between Turkmenistan (U.S.S.R.) and Khurasan (Iran) a snail of the family Enidae, which he named *Buliminus* (*Amphiscopus*) *continens*. Through the kindness of the Rev. H. E. J. Biggs of Bromley and Dr. A. Zilch of the Senckenberg Museum at Frankfurt a.M., I received for investigation paratypes of this species and specimens from three other localities in Iran. The latter differ so much from the paratypes, that they are described as new subspecies.

Jaminia (Euchondrus) continens continens (Rosen) (Fig. 1).

Buliminus (*Amphiscopus*) *continens* Rosen, 1892; *Nachr.-Bl. dtsch. malak. Ges.*, **24** (7/8), 125. Type locality (*restr. nov.*): Kasandshik (Turkmenistan, U.S.S.R.)—Kobelt 1901, *Iconographie Land- & Süsswasser Moll.*, N.F. **9** 48, pl. 257, fig. 1661 (shell).

Two paratypes from Kasandshik (Senckenberg Mus. No. 64121) have been examined. Both specimens differ from the original description only in the number of whorls, which is 7½ instead of 6½. They do not belong to the genus *Amphiscopus* Westerlund, 1887 (type species *Pupa sturmii* Küster, 1852), but to the genus *Jaminia* Risso, 1826 (type species *Jaminia heterostropha* Risso, 1826, = *Jaminia* (*Jaminia*) *quadridens heterostropha* Risso), and to the subgenus *Euchondrus* Boettger, 1883 (type species *Pupa chondriformis* Mousson, 1861); cf. Forcart (1940, 190, 199, 228).

U.S.S.R., Turkmenistan, Kasandshik. Iran, Khurasan, Schamhala, near Muhammabad.

Jaminia (Euchondrus) continens parthica[1] *ssp. nov.* (Fig. 2).

?*Buliminus* (*Amphiscopus*) *continens* Rosen in Smith 1899, *J. Linn. Soc. Lond.* (*Zool.*) **27** 392.

HOLOTYPE: Senckenberg Mus. No. 70455, from Iran, Prov. Samnan & Damghan, Shahrud.

PARATYPE: Senckenberg Mus. No. 70456, from the type locality.

DIAGNOSIS: *Jaminia continens parthica* differs from *Jaminia continens continens* in the smaller height and lighter colour of the shell.

The specimens described by Smith (1899, 392) from Iran, Prov. Azerbaijan, Koyun Daghi (= Koin Island in Lake Urmia) probably belong to this subspecies.

Jaminia (Euchondrus) continens carmanica[2] *ssp. nov.* (Fig. 3).

Ena sp. Biggs, 1937, *J. Conch.* **20**, 345, No. 13.

HOLOTYPE: British Museum, London, from Iran, Prov. Kerman, mountains east of Kerman, *leg.* Rev. H. E. J. Biggs, 1934.

PARATYPES: 2 in British Museum, 2 in Basle Museum of Natural History and 5 in Biggs collection from the type locality, and 7 from Seguch, south-east of Kerman at about 7,000 ft., in Biggs collection.

DIAGNOSIS: *Jaminia continens carmanica* differs from the other two subspecies of *Jaminia continens* in the greater diameter and height of the shell, and in the weak development of the apertural dentition. The complete dentition of *Jaminia continens* consists of one parietal lamella, one columellar lamella and two palatal plicae. In *Jaminia continens carmanica* one or more of these teeth may be missing or only developed as a small protuberance.

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[1] Derived from Parthia, classical name of the N.E. parts of Iran.

[2] Derived from Carmania, classical name for Kerman.

			Aperture.		
	Diameter. mm.	*Height. mm.*	*Width. mm.*	*Height mm.*	*Whorls.*
Jaminia continens continens (Rosen)					
paratype, Senck. Mus. No. 64121	2·2	7	1·7	2	7½
Jaminia continens parthica subsp. nov.					
holotype, Senck. Mus. No. 70455	2·3	5·8	1·6	1·9	6½
paratype, Senck. Mus. No. 70456	2·2	6	1·4	1·8	6½
Jaminia continens carmanica subsp. nov.					
holotype, Brit. Mus.	2·9	7·9	1·9	2·4	7⅒
paratype from Seguch (coll. Rev. H. E. J. Biggs).	2·8	7·4	1·7	2·1	6¾

Conclusions: The recent occurrences of the three subspecies of *Jaminia continens* are probably relics of an earlier uninterrupted distribution, which split into isolated populations of diverging evolution.

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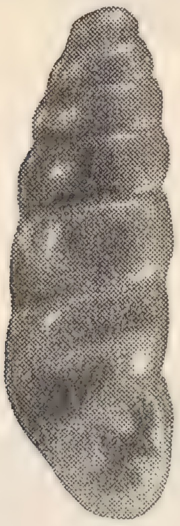

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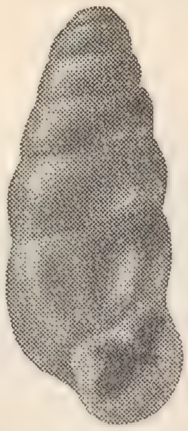

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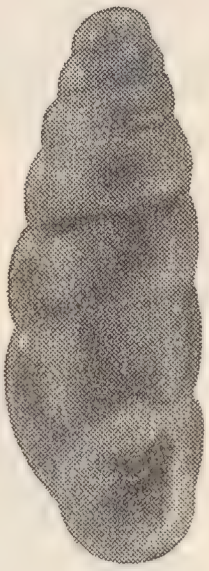

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FIG. 1.—*Jaminia* (*Euchondrus*) *continens continens* (Rosen). Paratype, Senck. Mus. No. 64121, from U.S.S.R., Turkmenistan, Kasandshik. × 5.

FIG. 2.—*Jaminia* (*Euchondrus*) *continens parthica* subspec. nov. Holotype, Senck. Mus. No. 70455, from Iran, prov. Samnan & Damghan, Shahrud. × 4·9.

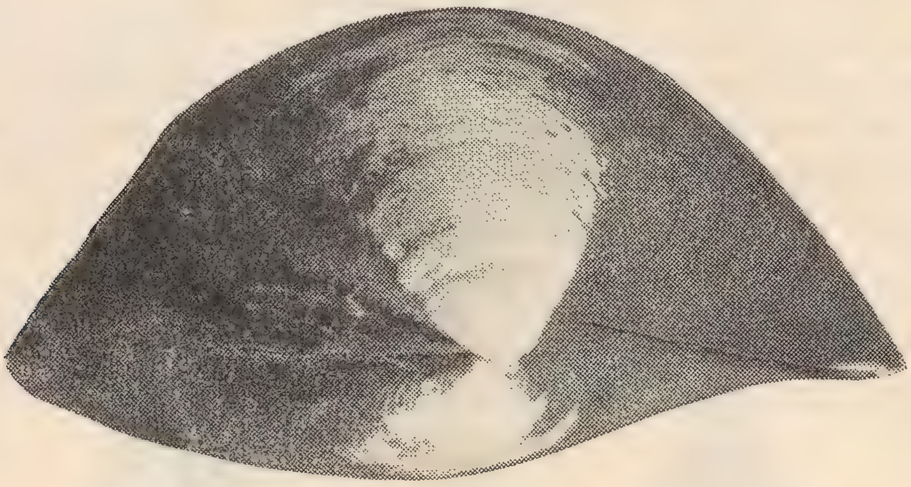
FIG. 3.—*Jaminia* (*Euchondrus*) *continens carmanica* subspec. nov. Holotype, Brit. Mus., from Iran, prov. Kerman, mountains east of Kerman. × 4·75.

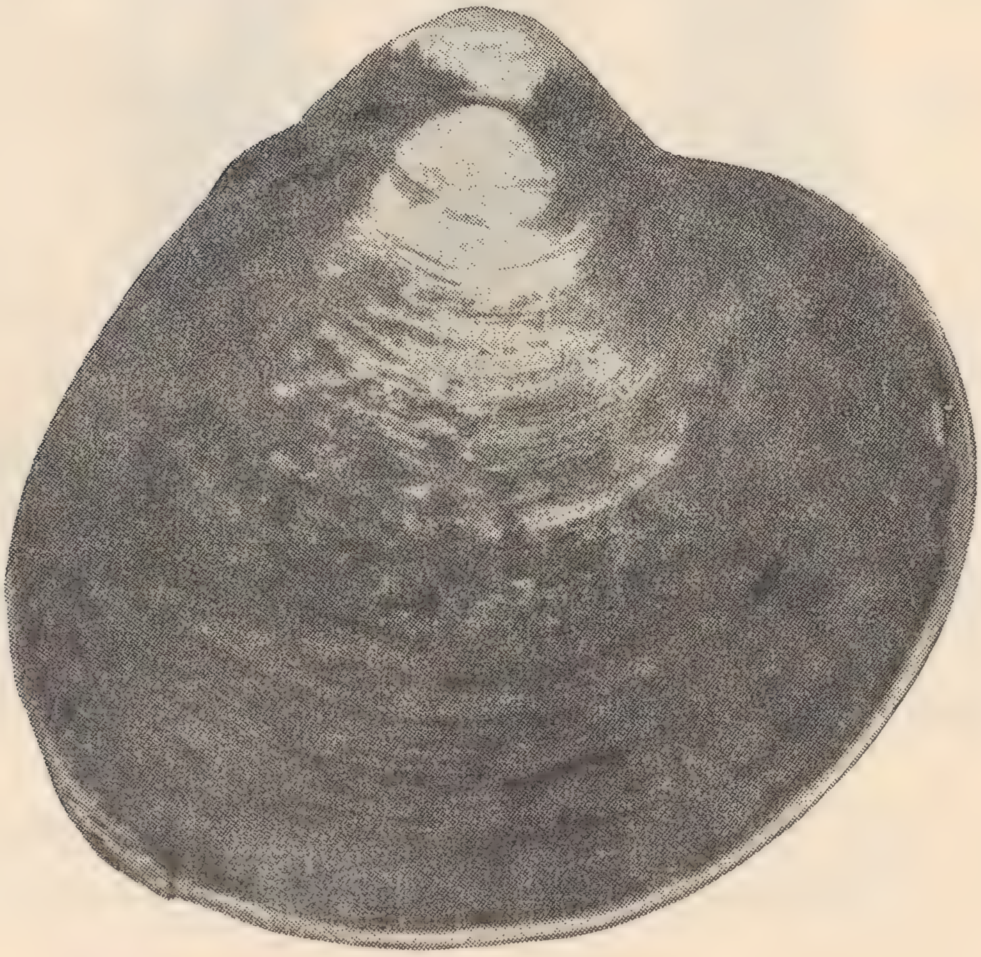
A MONSTROSITY OF *CYPRINA ISLANDICA* (L).

By HANS SCHLESCH, Ph.D., D.Sc.

(*Read before the Society*, 18 *October* 1958)

DEFORMED bivalves are often observed, the deformities being mostly caused by injury in the juvenile stage, or by the specimen being wedged between stones or possibly by summer periods. But so far as I have been able to trace in the literature, I have never seen a record of a bivalve, in which normally both valves are equally convex, having the right valve normal but the left nearly flat, although no injuries can be seen on the specimen (resembling *Pandora* in this respect). The abnormal specimen of *Cyprina islandica* (L.) of this character here figured was found in Midfjördur, Húnaflói, N.W. Iceland, 23 August 1924, on a clay bottom, 5–6 metres deep, by the late Diomedes Davidsson. Dimensions: height 50 mm., breadth 54 mm., diameter (or thickness) 24 mm. (of which 21 mm. is that of the normal right valve).





AN UNDESCRIBED POLYMORPHISM IN *HYGROMIA STRIOLATA* (C. PFEIFFER).

By A. J. Cain

(*Read before the Society,* 19 *April* 1958)

It is always of interest to distinguish polymorphisms from other forms of variation, since they are of special evolutionary interest and provide an unusual opportunity for investigating the action of natural selection; this subject has been reviewed by Ford (1). The usual practice of describing variation by naming particular forms as varieties does not distinguish between polymorphism and continuous variation. Furthermore, since the appearance of a snail is often compounded of the shell colours and something of the body pigments, seen through the shell, a study of variation may often require for completeness some account of what is usually boiled and thrown away—the so-called soft parts.

Examination of two random samples of 143 and 128 specimens of *Hygromia striolata* from a hedgerow at Godstow near Oxford, one of 275 specimens from a ditch near East Ilsley (Berkshire), one of 50 from Boars Hill near Oxford, and one of 44 from Wolvercote near Oxford, shows that variation in shell colour is markedly discontinuous. The exact colour of the shell can easily be observed if the animal is stimulated with a grass-stem to withdraw far up the body whorl, and the area of shell left free of body is examined by transmitted light. Two sharply distinct classes, red-brown and fawn, are easily recognized. Some shells are very pale indeed, almost white, and may perhaps form a third class, but there is some variation within the fawn class, and the apparent whites may be only the extremes of this. There is also, as might be expected, some variation within the red-brown class, but out of a total of 641 specimens examined, not more than five were in any way intermediate between red and fawn; these were all young individuals, which might have darkened somewhat into obvious red-browns if they had been allowed to grow up, although generally speaking there seems little change with age, and even very small shells can be scored readily.

In Taylor's (2) coloured plate the figures of both var. *albocincta* Cockerell and *rubens* Moquin-Tandon belong to the red-brown class. They differ in the presence or absence of a white peripheral band. In the specimens I have seen the band seems always to be present but may be obvious or more or less suffused with red; the two varieties seem therefore to intergrade. Taylor's three figures of "typical" specimens belong to the fawn class. His white specimen (var. *alba* Moquin-Tandon) is all white and does not agree with my white shells, in which the shell is not as white as the peripheral band, which consequently can still be seen in them.

The mantle of the animal can be seen through the shell, and as it varies from black to white it contributes considerably to the visible variation of the species. Four common classes are found in the samples examined, as a result of the combined variation in shell and body, namely:—

Shell.	*Body.*	*Result.*
Red-brown	Dark	Dark red-brown
Fawn	Dark	Dark blackish brown
Fawn	Light	Pale fawn
White	Light	Whitish

As can be seen from this list these are not all the possible combinations, and a few individuals with e.g. red-brown shell and light body are found. Table 1 gives the composition of the samples collected. It will be seen that fawn individuals are much the commonest in these samples, and red-brown ones the next. There is a striking deficiency of light-mantled animals in red-brown shells even on this rather crude method of scoring.

To check the scoring of animals in their shells, and to score the pigmentation of the mantle more accurately, I boiled almost all the large sample from East Ilsley and extracted each animal from its shell, so that the contributions made by the body and the shell to the appearance of each animal could be examined separately. Each body was kept with its shell, except that a number of the fawns and the reds could be dealt with *en masse*. Some of the smallest defied extraction but a total of 218 out of the 275 were prepared, as were also 56 out of the first sample from Godstow. The pigmentation is principally on the mantle and varies over a considerable range with no obvious gaps. The range was divided into 12 classes, from darkest (1), which was almost black, to those with almost no pigmentation (12). The pattern of pigmentation is too coarse for the mantle to be simply scored for shade against a standard colour atlas. The results are given in Table 2, and suggest that the accuracy of scoring the animal in its shell is good enough for most purposes, but three bodies had been classed while in their shells as dark (classes 1–7) which were seen to be light (classes 8–12) on extraction, and two as light which were really dark. Taking the distinction between dark and light as falling between classes 7 and 8, then, only 5 out of 218 bodies from East Ilsley were wrongly scored, and only 2 from Godstow ; but both samples show that there is no good reason to separate mediums and darks.

If the entries in Table 2 for " red shell, dark body " and " red shell medium body " are added together, and similarly all those for " fawn shell " are combined, it will be seen that there is a strong correlation between mantle pigmentation and shell colour in these samples, as indeed can be found also from Table 1. In the East Ilsley sample in Table 2 there are 51 dark-bodied red-browns (including mediums as darks) as against only one light-bodied red-brown, but 22 dark-bodied fawns (one of which had been wrongly scored on the entire animal as a light) as against 126 light bodied ones. The whites resemble the fawns strongly in their proportions—one dark-bodied to 17 light.

It is not possible to say from these data whether this correlation is caused by linkage between two different sets of genes, one controlling body colour and the other shell colour, or whether the same genes are controlling both, but body colour is affected also by many minor genes, producing a considerable spread of variation. Either way, it seems that in the habitats investigated, these snails are either light-bodied and light-shelled or dark-bodied and dark-shelled by preference, since these are the

TABLE 1.—Composition of random samples of *Hygromia striolata*.

Locality	White shell, dark body	White shell, light body	Fawn shell, light body	Fawn shell, slight mottling	Fawn shell, dark body	Red shell, medium body	Red shell, dark body	Total
Godstow 1 Jan. 57		8	86	—	12	37		143
Godstow 18 Jul. 57		18	68	1	13	13	16	129
E. Ilsley 15 Jul. 57		24	158	20	11	16	46	275
Boars Hill 18 Jul. 57		1	47	1	—	—	1	50
Wolvercote 22 Sept. 57	1	3	29	—	3	—	8	44
Total	1	54	388	22	39	29	108	641

TABLE 2.—Mantle colour and shell colour in two samples of *Hygromia striolata*

Mantle colour	1	2	3	4	5	6	7	8	9	10	11	12	Total
(1) East Ilsley													
Red shell, dark body	4	11	10	13	2	1							41
Red shell, medium body				1	4	3	2		1				11
Fawn, dark body		1		1	2	1			1				6
Fawn, medium body				4	5	7				1			17
Fawn, pale body							1	6	38	32	35	13	125
White, pale body							1	2	2	4	6	3	18
Total	4	12	10	19	13	12	4	8	42	37	41	16	218
(2) Godstow, 1													
Red shell, dark body	5	4	3	3	3	2							20
Fawn, dark body		2		1			1						4
Fawn, pale body							1	9	12	2	3		27
White, pale body							1		1	2		1	5
Total	5	6	3	4	3	2	3	9	13	4	3	1	56

commonest classes. This is rather unexpected, and suggests that a selective agent is at work causing individual snails to be produced which mimic either the light or the dark components of the rather variegated background on which they live, but not some intermediate shade.

It will be seen from Table 1 that the samples examined, from localities between 1 and 20 miles apart, are rather similar in composition ; but all the collections were made at the foot of hedgerows or in a ditch close to bushes, in all of which twigs, small stones and leaf-litter formed the greater part of the background. This also suggests that visual selection (presumably mainly by birds) is at work. Collections on backgrounds of very different appearance (e.g. in leaf-litter in a beechwood) might show significant differences in composition paralleling the variation in background colour from place to place as in *Cepaea nemoralis* (3).

Acknowledgments

I am grateful to Dr. D. Nichols and Dr. G. A. Harrison for assistance in collecting.

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A Check-List of East African non-marine Mollusca.—During the past few years I have been compiling a check-list of East African non-marine Mollusca, which is now completed in manuscript, together with some anatomical notes on several species. Since it is unlikely that botanical work will allow me time for the publication of this in the foreseeable future, this note is to draw attention to the material and notes available in Nairobi. Anyone undertaking revisional work on some genus which occurs in this area might find a typed extract from my notes, together with a loan of dry and spirit material, of assistance. A large proportion of the species is undescribed, and the genera need careful revision.

B. Verdcourt (Box 5166, Nairobi, Kenya).

Netherlands Malacological Society.—In commemoration of the 25th anniversary of its foundation, a meeting is being organized in Amsterdam on 27 and 28 June and in Leiden on 29 June. Foreign malacologists will be welcome, and those wishing to attend may obtain a programme from the Secretary, Mr. J. J. Bernard, Nieuwersluisstraat 67, 's-Gravenhage, Netherlands.

TWO UNUSUAL SNAIL COLONIES

By L. W. Stratton

(*Read before the Society*, 15 *November* 1958)

During 1958 two rather unusual colonies of the genus *Helix* were investigated, one in north-west Yorkshire, the other in Hertfordshire. Brief descriptions of these may be of interest.

Both *Helix* (*Cepaea*) *nemoralis* Linné and *H.* (*C.*) *hortensis* Müller occur in a number of well-defined colonies in the neighbourhood of Malham and Malham Tarn Field Centre, in north-west Yorks. During 1954 and 1955 fourteen colonies of the former and seven of the latter were discovered. In three instances the two species occurred together. In all fourteen colonies of *H.* (*C.*) *nemoralis* all the shells found were the normal brown-lipped form. In August 1958 another colony was found which showed an unusual variation, in that the majority of the shells had white lips.

This colony lives on the screes below Green Hill Scar, which is on the lower slopes of Fountains Fell. The amount of cliff showing above the screes is small, in some places as little as five or six feet. The screes have a vertical height of about a hundred feet, are grassed above and below with an area of loose limestone rubble between, and have a south-eastern aspect. The snails live both above and below the rubble. In this exposed position the older snails are much weathered.

A sample of 122 snails was taken at random, in that all adult snails were picked up as found, without regard to markings. Young snails were abundant, so that there was no fear of exterminating the colony; moreover, only a small area of scree was worked. When it was realized that some of the shells had white lips, the lips were not looked at when the snails were taken. All the shells had a yellow ground colour; none of any other colour was seen. In fact, of the fifteen colonies examined in the area, only one, at Darnbrook Cowside, contained any pink shells.

Of the 122 shells, 55 were unbanded, and only in these were there any with lips other than white. Of these unbanded shells, 9 had the normal brown lips, 14 had white lips, and in the remaining 32 the lips were of varying shades of pink, some with white internal ribs, some without. The 67 banded shells all had white lips, and of these 33 showed some fusion of the bands. Details of these banded shells is as follows: 12345—9; 10345—5; 00300—20; 123(45)—5; 103(45)—2; (12)345—4; 1(23)(45)—1; (12)3(45)—3; (123)(45)—16; (12345)—2. In all, 81 of the 122 shells had white lips.

As there was such a high proportion of white-lipped shells, over 66 per cent, some doubt was expressed as to whether the snails were indeed *H. nemoralis*. To make quite sure, Dr. H. E. Quick extracted the darts from a number of animals from both coloured and white-lipped shells, and these all proved to be typical *H. nemoralis* darts.

The author has from time to time collected odd specimens of *H.* (*C.*) *nemoralis* with white lips, but has never before seen so many in one colony. Ellis (*British Snails*, 1926) quotes Stelfox as saying that in the west and north of Ireland the white-lipped form sometimes outnumbers the coloured; and in 1956 Lieut. Col. R. J. Griffiths gave the author a sample from Niort, France, in which 20 of 22 shells were yellows and 11 had white lips.

On the same screes at Green Hill Scar, *Helicella itala* (Linné) was found with *H. nemoralis*. This is a rare snail in the Malham area, only one other small colony having been found so far. Other species present were *Hygromia hispida* (Linné), *Cochlicopa lubricella* (Stabile), *Arion ater* (Linné), and *Agriolimax reticulatus* (Müller).

Another colony of snails, this time *Helix* (*Cepaea*) *hortensis* Müller, was found in a garden at Redbourn, Hertfordshire. This garden, once well cultivated, had been untouched for two years, and by 1958 had become a complete wilderness. This year having been a particularly wet one, and 1957 but little less so, the place had become a paradise for snails. These were first noticed on clumps of *Phlox* which had pushed their way through the masses of weeds, and, as a fair proportion were of the form *lilacina* Taylor, the shells were preserved.

During the summer of 1958 a large part of the garden was cleared, and some idea of the actual snail population became apparent. In the interests of future gardening all *H. hortensis* were removed and to date the total of adults is 314. Of these 148 are typical 12345 shells and 138 var. *lilacina*. Of the rest, 23 are plain yellows, and the band variations are: 12045—2; 10345—1; (12)345—1; 1(23)45—7; 123(45)—1; 1(23)(45)—1; 1(2345)—1; (123)45—5; (123)(45)—4; (12345)—2.

The high proportion of var. *lilacina* (44 per cent) is remarkable, and is probably due to the almost complete isolation of the colony. The garden is bounded on the east by the house, on the south and west by high brick walls, and on the north is separated by a quickset hedge from Redbourn Common, a large expanse of grassland regularly mown, on which no *H. hortensis* have been seen. These lilac shells vary from very dark to very pale shades of this colour, and some have zones which are almost white. Many of them show a good deal of this lilac colouring in the lips.

This variety does not appear to be common, and seldom occurs in any abundance. In the garden of Juniper Hall, Surrey, where in box hedges the population numbers many hundreds, a dozen var. *lilacina* would be exceptional. It occurs sparingly on near-by Box Hill, and the author has taken it at Badbury Rings in Dorset. All the loci are highly calcareous, though this may not be relevant.

SAXICAVELLA JEFFREYSI WINCKWORTH AT PLYMOUTH

By N. A. Holme

The name *Saxicavella jeffreysi* was given by Winckworth (1930) to a small member of the Hiatellidae described by Jeffreys (1865, p. 75) under the name *Panopea plicata* (Montagu). Winckworth states that there is some doubt as to the identity of Montagu's (1808) *Mytilus plicatus*, and that the name is in any case preoccupied by Gmelin. *S. jeffreysi* is a rare mollusc, but has been reported from a number of localities in European waters and as far south as the Canary Islands. A list of localities is given by Jeffreys and by Massy (1930); in addition empty valves are recorded from Iceland by Madsen (1949). Massy gives the depth range as 9–2,307 m.

In a survey of the bottom-fauna off Plymouth (Holme, 1953), living specimens were taken at one station and listed at the time as *Thracia* sp. Additional specimens were taken in 1954.

Station C4. (Holme, 1953, p. 21). 7.xi.1950. 50° 11′ N., 04° 05′ W.
Depth 57 m. Clean sand. Four specimens (10 specimens, probably of this species, passing the 2·2 mm. sieve were lost, and could not be determined with certainty).

Station B5. 6.viii.1954. 50° 10′ N., 04° 10′ W.
Depth 60 m. Clean sand. Six specimens and some empty valves.

This species had previously been recorded from Plymouth only "among trawl refuse" by Jeffreys, and there are no reports of it among the records of the Marine Biological Association. It may be identified from the description in Jeffreys and the illustrations in Forbes and Hanley (1853, pl. 6, figs. 1–3). The valves are widest towards the posterior end, and the concentric sculpture is much finer than in *Hiatella*. It differs from *Sphenia binghami* Turton chiefly in the presence of an external ligament and in other details of the hinge. The soft parts do not seem to have been described.

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[1] Date on title page. Plate 6 was published in 1848.

OBITUARY.

E. W. SWANTON, 1870–1958.

ERNEST WILLIAM SWANTON was born at Manor Farm, Dibden, Hampshire, on 28 June 1870, and died at Twickenham on 21 October 1958. When he was one year old, his family moved to Bratton St. Maur, Somerset. He was educated at Pine House School, Wincanton, Winton's School, Clifton, and Bruton Grammar School. After a few years as schoolmaster and private tutor, he was appointed curator of Jonathan Hutchinson's Museum at Haslemere, Surrey, in 1897, and was in charge of this celebrated educational museum for over fifty years. He was appointed M.B.E. in 1936, O.B.E. in the year of his retirement, and elected Associate (*honoris causa*) of the Linnean Society of London in 1920. He was a founder member of the British Mycological Society, of which he was President in 1916. Swanton became a member of the Conchological Society in 1892, was President in 1921 and was elected an Honorary Member in 1955. During the last year of his life he wrote *A Brief Autobiography* (" Concerning Myself "), with a complete list of his papers and books, followed by *Memories and Notes* just before his death. Both pamphlets contain a portrait, and were printed by Thomasons, Ltd., Cedar Press, Hounslow. An obituary appeared in *The Times*, 23 October 1958.

Swanton's best known conchological works are *A pocket guide to the British non-marine Mollusca* (1906) and *The Mollusca of Somerset* (1912). He later became mainly interested in plant-galls and fungi, on both of which he wrote guide-books, and published a book on *The Yew Trees of England* (1958). His book, *A Country Museum* (1947) recounts the history of Haslemere Educational Museum. The following appreciation of his work in connection with this museum is quoted, by permission, from *The Times*: " Swanton gave himself with enthusiasm to the work. In 1898 he began to give courses in natural history, at the museum, to children from the local elementary schools and continued to do so until his retirement in 1948—sometimes lecturing to nearly 10,000 children in a year. He began, in 1899, another feature which continued throughout his curatorship—the museum examination held usually every two years. He made the museum, moreover, a widely felt influence in the life of its locality in many other ways, among them the contribution of regular " Museum Notes " to the local paper, and the ready hospitality and encouragement given to local and visiting natural history, gardening, artistic, literary and other societies. He attracted the help of many local residents, some of them specialists in various branches of study. Thus the work continually expanded, and in 1926 he had the gratification of seeing the museum, which had been handed over to trustees, moved to the excellent permanent quarters it now occupies."

Swanton was an all-round naturalist of wide interests, of a type becoming regrettably rare in these days of increasing specialization. He knew something about many things and a great deal about some groups of animals and plants. The museum which he made famous is his lasting memorial.

Swanton married Annie Elizabeth Cobbold in 1900; she died in 1957. He has recorded in *A Country Museum* how much Haslemere was indebted to her during their fifty years work there.

Latiaxis fritschi **(von Martens) and** ***Fusus speratus*** **(Cossman).**—In recording (*J. Conch.* **24,** 180) the radula of what was supposed to be *Latiaxis fritschi*, I made a most unfortunate error by comparing the Mossel Bay specimens with specimens which had been identified as *fritschi.* Tomlin himself has mentioned the difficulty of correlating unworn specimens with descriptions based on beach-worn material (*Ann. S. Afr. Mus.* **25,** 313). Since then I have seen von Martens' illustration of his species, and a re-examination of all available material leaves no doubt as to which specimens are the true *fritschi.* Moreover a specimen containing the animal has been found in the South African Museum collection. It has a most ornate 5-whorled protoconch, and no radula. The species must therefore be returned to *Latiaxis*, though I think *Coralliophila* would be better. A further result is the recognition of the Mossel Bay specimens as *Fusus cingulatus* Smith (1904), renamed *speratus* by Cossman (1921). This must be transferred to *Tritonalia*; a description of the unworn shell will be given in Part 2 of my Revision of South African Marine Mollusca.

K. H. BARNARD.

Planorbis vortex **(L.) with double aperture.**—In late April 1958 Mr. Christopher Paul collected some specimens of *Planorbis vortex*, the shell of one of which had two apertures, in watercress beds of the River Gade at Cassio Park, Watford. The two apertures of the abnormal shell, which measured 4·5 mm in diameter, were set at an angle of about 45 degrees apart on the body-whorl. The penultimate aperture, which was the one in use by the animal, was set at a slight angle to the periphery. The snail lived in a small aquarium for about two months, the empty shell being found on the floor of the tank at the end of June. The ultimate or normal aperture was then seen to be almost completely blocked by a grain of quartz, which suggests the possibility that the formation of the second aperture was to compensate for this mischance. Records of Planorbidae with two apertures seem to be rare, although other kinds of distortion are not infrequently met with in this family. I have not so far traced any account of a similar case.

T. E. CROWLEY.

(*Read before the Society*, 13 *December* 1958)

REVIEWS

Contributions to the knowledge of South African Marine Mollusca. Part I. Gastropoda: Prosobranchiata: Toxoglossa. K. H. BARNARD, D.Sc., F.L.S. (30 text-figures and 1 plate.) *Annals of the South African Museum*, vol. 44, pt. 4, pp. 73–163. July 1958. 15*s*.

IT is fortunate that students of the South African marine fauna with all its novelties have, for so long, had the services of such a painstaking and able malacologist as Dr. Barnard. This important contribution, the first, we hope, of several such, embraces the families Terebridae, Conidae and Turritidae, the latter occupying some three-quarters of the whole work. One new species of *Terebra* is described and many turrids. The line drawings, by the author, are good, especially those of the protoconchs and profiles of the turrids, though some workers may find the lack of full length drawings of the new species a little disconcerting. It is, perhaps, unfortunate that the author does not select a holotype for the species represented by more than one example, the more so as several descriptions are based on materials from more than one source. The remarks under many of the species are most instructive and should not be missed when reading the diagnoses. It is certain that this paper is going to be very useful to all interested in South African Mollusca and we look forward to further contributions from Dr. Barnard's able pen.

S. P. DANCE.

Molluscs. J. E. MORTON. Pp. 232, 23 text-figures. Hutchinson University Library, London, 1958. 10*s*. 6*d*.

NO group in the animal kingdom, except perhaps the Insecta, is so admirably suitable for study by both the amateur and the professional naturalist as the Mollusca. Marine, fresh water and terrestrial habitats provide abundant material, and as the author says " Molluscs are easily caught, patient of observation and wonderfully diverse in their adaptations ". The literature on them is vast, yet no general work on the phylum has been published in this country for many years.

One of the most active and thoughtful of the younger generation of malacologists has now, from his wide knowledge of the group, written an excellent book on the living mollusc, on its form, movement, habits, the function of its organs and its remarkable adaptability and evolution. Dr. Morton has summarized the most important parts of the literature and added his own pertinent comments and suggestive ideas. In his Introduction he hopes that the beginner will be able to profit by his treatise, but a complete understanding of the book depends upon a knowledge of the terminology of anatomy, systematics and physiology far beyond that of the uninitiated. A glossary and a more comprehensive index would have helped, for although he defines structures and substances in the text, there is often no means of finding his definition easily, since the index does not always include it (e.g. 148, 151, otocyst; 149, 152, statocyst).

The book is printed in the Times New Roman type and is easy to read. The illustrations are mostly copied or are diagrammatic. Some are lettered, others numbered, sometimes the same number being used for different organs in parts of the same figure ; this is confusing.

The text ends abruptly. A summary or general statement would have provided a more graceful termination. An appendix with a detailed classification, based on Thiele, is helpful, but where is the " folding out sheet " mentioned in the Introduction ? A short account of that interesting Monoplacophoran *Neopilina* follows and there is a Bibliography of more than 200 items.

Molluscs can be recommended as a valuable summary of modern knowledge of this large and important phylum.

N. B. EALES.

***Caecum folini* nom. nov.**—The examination of the Caecidae obtained during the voyage of H.M.S. *Challenger* was entrusted to Marquis Léopold de Folin. Among several new species he described was *Caecum eburneum* (1886, *Challenger Reports*, Zoology, vol. 15, app. B, p. 688). The holotype, from Wednesday Island, Cape York, is in the British Museum (Natural History). In the course of an examination of the Caecidae described by de Folin, it has come to my notice that the name *Caecum eburneum* is preoccupied by *C. eburneum* C. B. Adams, 1852, from Panama. The name **Caecum folini** is therefore proposed in place of *C. eburneum* de Folin.

B. S. KISCH.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

765th Meeting, held at the British Museum (Natural History), 18 October 1958.

Mr. L. W. Stratton, vice-president, in the chair.

Communications.

" *Saxicavella jeffreysi* Winckworth at Plymouth," by N. A. Holme.

" A monstrosity of *Cyprina islandica* (L.)," by Hans Schlesch.

Notes on oyster catchers feeding on limpets and on thrushes eating *Viviparus*, by G. W. Pitchford.

Exhibits.

Special exhibits : Marginellidae and *Tortulosa* : examples were shown by Mr. G. A. S. Barnacle, Mr. T. Pain, Mr. R. P. Scase, Mr. L. W. Stratton and (from the British Museum collections) by Mr. C. P. Castell and Mr. S. P. Dance.

Mr. S. P. Dance : *Hygromia limbata* collected at Hampstead by G. B. Sowerby in 1832 ; da Costa's *British Conchology* and the original plates drawn by P. Brown, to show reversal and poor quality of the reproductions.

Mr. B. S. Kisch : Patellidae from Biarritz filter basin ; a selection of colour forms of *Chlamys varia* obtained in the market at St. Jean-de-Lux.

Mr. L. C. Prebble : Cuban shells.

Mr. R. P. Scase : *Chama lazarus*, Guam ; *Voluta pulchra*, Heron I., Queensland ; *Cypraea coxeni*, New Georgia.

766th Meeting, held at the British Museum (Natural History), 15 November 1958.

The President, the Rev. H. E. J. Biggs, in the chair.

Member Deceased.

The President reported the death of Ernest William Swanton, O.B.E., A.L.S., the senior vice-president of the Society.

Members Elected.

Dr. John Bowden, Department of Anatomy, Queen's University, Belfast, Northern Ireland.
J. R. Duckworth, 43 Lowergate, Clitheroe, Lancashire.
Edwin W. Fletcher, 37 Holland Road, Kensington, London, W. 14.
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Miss Ruth D. Turner, Museum of Comparative Zoology, Cambridge 38, Mass., U.S.A.
Frederick Richard Woodward, 49 Bunbury Road, Northfield, Birmingham 31.

Communications.

" *Vitrina* adhering to birds," by S. P. Dance.

" Two new subspecies of *Jaminia* (*Euchondrus*) *continens* (Rosen) from Iran," by L. Forcart.

" Two unusual snail colonies," by L. W. Stratton.

Exhibits.

Special exhibits : Donacidae and Hydrobiidae.

Mr. C. P. Castell : Recent and fossil Hydrobiidae from the British Museum collections.

Mr. S. P. Dance : Hydrobiidae from the British Museum collections ; illustrations of Donacidae in Chenu's *Leçons élémentaires d'Histoire naturelle* (1847) and Martini und Chemnitz, *Conchilien-Cabinet*, Donacidae by E. Römer (1869). Mr. Dance also gave a brief survey of the Hydrobiidae.

Mr. A. E. Ellis : British Recent and Pleistocene Hydrobiidae.

Dr. L. Forcart : Specimens to illustrate his paper.

Mr. L. W. Stratton : Australian and North America Donacidae ; *Arianta arbustorum* showing interrupted growth in 1955, contrasted with others from the same locality in the wet summer of 1958, with no indication of aestivation ; also band and colour variations of *Helix* (*Cepaea*).

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CONTENTS.

PAGE

Officers and Council for 1959–60 331

A contribution to the study of the genus *Eremina* Pfeiffer, 1885—H. E. J. BIGGS 332

Some land Mollusca from northern Iraq—H. E. J. BIGGS . 342

The eggs of *Vitrina pellucida* (Müller)—G. W. PITCHFORD . 348

Opercula of calcite in the Bithyniinae—D. CURRY . . . 349

Gyrina gigantea (Lamarck), an unexpected addition to the South African marine fauna—S. P. DANCE 351

Inheritance of mantle colour in *Hygromia striolata* (C. Pfeiffer) —A. J. CAIN 352

Agriolimax caruanae Pollonera new to Ireland—P. MAKINGS . 354

A giant *Achatina* from the Belgian Congo (*Achatina* (*Achatina*) *balteata infrafusca* von Martens)—T. PAIN 356

Orthalicus (*Metorthalicus*) *labeo* (Broderip): a rare Peruvian land snail—T. PAIN 357

Potamopyrgus jenkinsi (Smith) in West Donegal—A. W. STELFOX 358

Obituary: Hugh Watson 359

Review 361

Proceedings: December, 1958; January, February (Annual Meeting), March, April, May, 1959 362

List of Members 368

Accounts for 1958 375

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A CONTRIBUTION TO THE STUDY OF THE GENUS *EREMINA* PFEIFFER, 1885

By Rev. H. E. J. Biggs, F.L.S.

(*Presidential Address, delivered* 21 *February,* 1959)

The material on which the present study is based was obtained in northern Egypt, Sinai and Palestine between the years 1937 and 1942. It was collected mostly by myself, but other most useful material was collected by friends, both civil and military, who went to places I had not myself the opportunity of visiting. Those collected by members of the Long Range Desert Group would have been more useful had they been allowed to give me the locality where found, but for security reasons they could not do so. It might well have extended our knowledge of the distribution of some forms.

My collection will eventually be placed in the British Museum (Natural History). I am, therefore, in many cases giving my catalogue number to the sets or single shells referred to so that, in the future, should a student wish to check up on my work there will be no doubt as to what I am referring.

It is impossible in the course of this address to go into all details of nomenclature, nor is it necessary. Some early writers, not knowing the extent of variation in the genus, gave descriptions which were adequate enough in their day, but are not now sufficient clearly to separate closely related yet distinct forms. There is therefore room for legitimate divergence of opinion as to which name should be applied to which form in the genus. So first let us define some of the forms which will be dealt with in the present paper.

NOMENCLATURE OF THE FORMS OF *Eremina*

(*a*) *desertorum* Forskål, 1775. This was the first species of the genus to be described and there has never been any doubt as to either the name or the type of shell to which it should be applied. Forskål writes that it was taken in the desert between Cairo and Suez. In those days they travelled by caravan; I have a set No. 455 taken close to the old caravan route from Cairo to Suez and not very far from Cairo. I feel we can take these shells as typical of the form of the group to which the name *desertorum* should be applied.

(*b*) *desertorum* var. ***dancei*** var. nov. From typical *desertorum* this form differs as follows: smaller, umbilicus much more open, mouth more rounded, suture more deeply impressed. This latter character makes the upper whorls appear much more rounded, giving the spire slightly greater height. The deep chestnut brown bands are broken, but the general aspect is of a much darker shell than the type. The costulations along the lines of growth are high and ivory white, the lip sharp and slightly reflected. Type (in British Museum) 19·2 × 12·7 mm.; 14 paratypes in my collection (Set. 527). El Firdan, Canal Zone, Egypt, *leg.* S.P. Dance, 6. xii.1952.

Most of these specimens were received alive and an attempt to keep them, so that they would surely be fully grown, was unsuccessful. However, two were found soon after death and the jaws extracted. One is typical *desertorum* with two ridges, but they are much larger than normal. The other is remarkable. Instead of two distinct ridges it has one very large one almost central, the second being rudimentary, thus giving the appearance of a one-ridged jaw. This bears witness to the great variability of the jaw in this group of snails and suggests that the evidence of jaw alone is not enough to separate the so-called species. We shall deal more fully with this matter later.

(*c*) *ehrenbergi* Roth, 1839. This is the correct name for the large, white, heavy shell found in the deserts east of the Nile. Kaltenbach (1934) has used the name *hasselquisti* Ehrenberg, 1831, for this form. Ehrenberg divided *desertorum* into two varieties ; to one he gave the name *forskalii*, and refers to Férussac, plate 28, fig. 1–8. None of these is true *desertorum*, and they are given the generic name *Helicogena*. To the other he gave the name *hasselquisti*, the reference being to fig. 10–12 of the same plate. Of these three one can say that fig.10 (together with fig. 9, not included by Ehrenberg) is normal *desertorum*. Figs. 11 and 12 are in the " Explication des planches ", p. xij, of Férussac, named *Helicogena lucana* Müller, i.e. not an *Eremina* at all. Again, describing the shell to which he wishes to attach the name *hasselquisti* he says, amongst other things, " . . . obsolete flavofusco interrupte fasciata, spira turgida globosior." The pages in Ehrenberg are not numbered, but in the copy in the British Museum the numbers have been inserted, and this description occurs on p. 78. On p. 79 he says, " In omnibus speciminibus umbilicus apertus, interdum obsoletus, reperitur." In another place he says that the form is found behind Alexandria.

In a MS. report on the land Mollusca of an expedition to Siwa Oasis written many years ago, which I was privileged to see, Mr. G. I. Crawford came to the same conlusion, namely that *ehrenbergi* Roth must be applied and the name *hasselquisti* Ehrenberg set aside. In a recent letter Mr. Crawford tells me he has not changed his opinion. The figure and description given by Roth leave no room for doubt to what sort of mollusc he is referring.

However, in order that all the available evidence may be before you, I would mention that on one occasion I was in Lappas' grocer's shop in Cairo and saw a basket of snails which I was told " had come from Alexandria ". I had permission to work through them ; there were at a rough estimate about 5,000. These were to my mind mostly *ehrenbergi* Roth, but some (Set No. 386) were marked with brown in varying degrees, the " obsolete flavofusco interrupte fasciata " of Ehrenberg's description of *hasselquisti*. But, and this is important, there is no trace of umbilicus in even the young shells, thus ruling out the application of Ehrenberg's name to this form. It should also be noted that the locality or origin for my set is not certain, and that these coloured shells represent only one per cent of those examined.

The most interesting specimen in this basket was a planorboid shell (No. 387) ; even that has no umbilicus. In the type collection in the British Museum there is a shell labelled the type of *dillwyniana* Pfeiffer, which

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has an umbilicus, but this specimen is, in my opinion, a unique monstrosity of *ehrenbergi* Roth.

(*d*) *chilembia* Bourguignat, 1864. The shells to which this name is attached are those which gave an excessive outgrowth of shelly matter at the aperture, more commonly found in examples taken near the coast, occasionally inland. The exact cause of this is not apparent, but may be due to climatic conditions. The name has little value. This same form of accretion to the aperture is found in the form *zitteli* Boettger of the species *ehrenbergi* Roth. This form, *zitteli*, is also found at the coastal end of the road from Mersa Matruh to Siwa.

(*e*) *ehrenbergi* Roth form *hofi* Kaltenbach, 1942. This form was described as an ecological race from Jebel Hof. I have two from near Mersa Matruh which, except for size, seem to fit this figure and description by Kaltenbach, but they are slightly larger, 24·6 × 20·2 mm. and 22·8 × 20 mm. A series from Heliopolis (not far from Jebel Hof) is of this form, but is quite white and may need a new name; temporarily I am referring this set (No. 313) to *hofi*. The measurements approximate to those of Kaltenbach's figures, namely 24·8 × 18·8 mm., in that the average for the 8 examples of the set is 21·6 × 18 mm., but one is only 19·6 × 16·3 mm. A particularly difficult series to place (No. 365) is one from Jebel Ataqa. These shells from the north-east slopes have some of the characteristics of *hofi*, but others are far from it. The ribbing of the whorls is more characteristic of *desertorum*, whereas *hofi* is a form of *ehrenbergi* and should have ribbing like that species. One of the series (No. 365/6) shows the accretions to the mouth, a character of *chilembia*.

(*f*) *ehrenbergi* Roth form *zitteli* Boettger. This form occurs south of the port of Mersa Matruh on the road to Siwa Oasis. It is the most aberrant form of the *Eremina* complex, being strongly keeled and with close strongly marked striations along the lines of growth. Pallary (1924) created the sub-genus *Nomma* for the reception of this extraordinary form. Iredale (1924) described it as *Exiliberus jacksoni*. Kaltenbach (1934) showed from his collections that there is an intergrading between the true *ehrenbergi* Roth (which he calls *hasselquisti* Ehrenberg) and the form *zitteli* Boettger. Connolly (1945) showed that Iredale's so-called new species and genus were none other than the form already named *zitteli*, so that both the generic and the sub-generic names have been proved valueless. Attention was, however, called by Iredale's reference to the similarity of our present sub-species to *Iberus gualterianus* L. from Spain to the fact that there were two very similar species at the two ends of the Mediterranean. I should like to call attention to Boettger's paper of 1913, in which he proves that *gualterianus* intergrades completely with *Iberus alonensis* Férussac, which is a species similar in general shape to *E. ehrenbergi*.

Thus we have, in Spain and Egypt, at either end of the Mediterranean basin, a transition from a globose shell to a strongly keeled and ridged form in otherwise quite unrelated genera, or complexes would be the better name. Here then is a problem which would well repay study as to the ecological conditions under which both live. Is there some element in the environment, or is there some characteristic of the mantle which under certain stimuli produces the same result in the shell ?

(*g*) *yamumensis* Kaltenbach 1942. This fine and distinct form is, according to its author, a variety of *E. kobelti* Westerlund. My sets, No. 352 from 13 km. north-west of Bir Gandeli, and No. 358 from 19 km. north-west of Bir Gandeli, were collected whilst out with Kaltenbach. I assigned the form at once to *desertorum* with some *ehrenbergi* strain. After having deferred to Kaltenbach's view for some years I now feel I must go back to my original view, and for the following reasons. In his description of the variety Kaltenbach states that the costulations are generally similar to *hasselquisti* (= *ehrenbergi*), but that in between them the *desertorum* form of costulation is found. Also he says that the jaw has normally 2 teeth and sporadically 3. Both these characteristics point towards the form's origin as a natural hybrid. Furthermore, Jebel Yamum lies between the Petrified Forest, where *ehrenbergi* predominates, and the Cairo–Suez road, where *desertorum* predominates, therefore in such a situation it would be rather extraordinary if hybridisation did not take place. The name *yamumensis* is a good and valid one and therefore should be used for this hybrid.

This form was sent to Paul Pallary and he named it *rhodia* Chemnitz. It certainly bears resemblance to Chemnitz's figure, but it is open to question whether or not the genus occurs on the island of Rhodes. The two possibilities are that perhaps Chemnitz had before him shells introduced by man (i.e. for food) from Egypt or, more probably, that the examples are *Levantina* sp. and not *Eremina* at all.

ENVIRONMENT

Generally speaking the habitat of *Eremina* is the open desert, exposed to great variations of temperature every 24 hours. Around Cairo, near Gizeh for instance, there are escarpments of nummulitic limestone pitted and scored by the wind-driven sand, broken in fragments by the expansion and contraction of the surface under the heat of the sun at midday and the cold at night. These fall off and are strewn down the hillside and again worn and carved, sometimes into grotesque forms, by the driven sand. In between the rocks sand accumulates and here and there bushes are able to obtain a foothold and flourish. On these bushes and hiding in the holes of the boulders and large masses of rock, *E. desertorum* seems to be quite at home. On the east side of Cairo there are some wadis running in an east–west direction, Wadi Digla and Wadi Tih for instance. Just to the north and west of these wadis lie the Greater and Lesser Petrified Forests. Here *E. ehrenbergi* is common and feeds on the lichens which grow on the broken pieces of fossilised tree trunk. In both places the snails remain sealed to the stones and rocks for a considerable part of the year, but sometimes they are watered by dew and the heavy mists which cover the deserts like a blanket, depositing their moisture and making the lichens thrive and allowing the snails to move about.

I had the privilege of the acquaintance of Dr. Hugh B. Cott of Cambridge whilst he was in Cairo as an officer in the British Army in Egypt. He informed me that the heat in the desert between Mersa Matruh and Siwa Oasis (the habitat of *E. ehrenbergi* and its race *zitteli*) was so great on one occasion that water carried on a car for drinking purposes became as hot as tea is usually drunk. At Ma'aten Bagush, on the north coast of Egypt, the temperature in July was 126° F. in the shade. This was in 1941 I presume, as he made the statement in 1942. He also stated that in July, 70 miles inland from Mersa Matruh at 6.30 a.m., just before sunrise, the state of the atmosphere could only be described as a thick fog with visibility only a few yards, and that water was dripping from the car as in rain.

Dr. W. F. Hume (1925, p. 45) records " When the present writer accompanied a reconnaisance to the east of the Canal the small bivouac tents occupied at night were soaked with moisture in the early morning". There are many other testimonies by travellers which could be quoted if necessary, but I think the foregoing are enough to prove that there is an ample supply of water for snails, other than the precarious source in the form of rain.

Density of Population

On 5 November 1938 I travelled with Dr. H. Kaltenbach from Cairo to Alexandria along the desert road. At the 98 km. post south of Alexandria (99 km. north of Gizeh Pyramids) I took a sample from a low bush about 2 feet high, the width of which was 2 feet 6 inches by 1 foot 6 inches. I did not select the bush but took it at random. There were 41 living snails on it and my journal notes : " There were as many again dead on the ground and stuck to the bush also dead in a big cluster ". At a point 7 km. north of this we again stopped and explored a big sandy area well covered with small grass tufts. My journal records : " Only 3 live *desertorum*, two were close together on one side of the road and the other well away on the other. I covered a wide area about a ¼ mile out from the road ; Kaltenbach about ½ mile and he only got two live shells."

On this side of the Nile Delta (western side) in a number of places the desert sand is encroaching on the cultivated land. *E. desertorum* is very plentiful in some places and then gets wiped out by this sand drifting, and has some difficulty in re-establishing itself on the new kind of vegetation that manages to grow up in the newly drifted sand.

At some points along this road on either side may be found large numbers of dead shells of a very large form of *desertorum*. This form does not live in this area nor do I yet know exactly where it does live. The present theory is that they were brought there from some area where they are plentiful by the relations of the road workers for food and the empty shells thrown aside. The utmost caution should therefore be exercised when attempting to estimate the density of species population from the relative abundance of dead shells.

Breeding Habits

E. desertorum breeds in the late autumn. On 31 October 1937 I made observations on egg laying by this species, in a depression full of sand in the nummulitic limestone near the second of the three pyramids at Gizeh, west of Cairo. There were five ovipositing at the time and they are numbered set 300 in my collection.

Each snail bored a hole in the sand, which was damp just below the surface. We had had a very heavy storm four days before, which may account for the dampness, although the surface was dry. With its head and fore part of the foot the snail excavates a hole and the damp sand brought up is deposited round the shell like strips of goffered ribbon. The depths at which four of the snails were working were, No. 1 : 41 mm., No. 2 : 55 mm., No. 4 : 39 mm., No. 5 : 57 mm. No. 3 was lying half buried in the sand with mouth upwards as if exhausted ; its hole was not measured, as some sand had fallen into it and it was not clean and defined as were the other holes. On 7 November I again visited the spot. Rain had fallen the previous night, but the wind was strong from the north-east and the sand was being driven by it over the area. The sand was dry down to between 3 and 4 inches, so there was no egg-laying going on.

On 5 November 1938, Dr. Kaltenbach and I collected series of shells at many stopping places on the desert road between Cairo and Alexandria. At 51 km. south of the Mex Light at Alexandria we took numbers of the form of *desertorum* he has since named *mariuti*. Very many of these were laying eggs, but on this occasion it was raining ; the country was well vegetated and apparently under occasional cultivation either by Bedowin or villagers. It is typical of the confusion which exists when I record that shells from this batch which were sent to M. Paul Pallary were named by him *hasselquisti* Ehrenberg. I estimate that these shells must have been taken from a spot very near that mentioned in Ehrenberg's work, in which case Pallary may be right, but Kaltenbach puts them in the *desertorum* group.

THE EXISTENCE OF CATENATIONS* IN THE *EREMINA* COMPLEX

I think it highly probable that the large number of described forms within this group can be accounted for by the idea that interbreeding takes place in nature. Random series of snails taken on occasions are very perplexing and it is impossible to place all of them in one species group or another.

On 11 March 1940 I was taken by road from Heliopolis to Suez. Stops were made at several points for collecting. At the 56 km. post my journal notes that I only took a few dead shells. This is set No. 737 and is, in my opinion, a catenation between true *desertorum* and *ehrenbergi*, some of which are of the form of the latter species now known as *hofi* Kaltenbach. The grading is firstly from the close and distinct costulations of the former species to the more widely set costulations of the latter species, secondly from the open umbilicus to closed, and thirdly from the deeper to the shallower suture. It is also to be noted that the graduation of these three characteristics is not relatively the same, i.e. the change of costulation is quicker than the change in depth of suture. This again was a set collected at random and not selected.

The catenation between *E. ehrenbergi* Roth and its form or subspecies *zitteli* Boettger has already been referred to above. This is perhaps the most striking catenation of them all.

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* Lat. *catena*, a chain, " a series of things or persons connected together."

POSSIBLE *fourtaui* × *hemprichi* CROSS

The form *fourtaui* Pallary (1924) is a very distinct one, being very flat, almost planorboid, consequently widely umbilicated and with underside rounded. It occurs to my knowledge only in the Sinai Peninsula. The form *hemprichi* Ehrenberg is much more elevated, globose, with umbilicus almost closed, banded with deep brown markings. It occurs in several habitats, but in the dunes near Gaza, Palestine, it was the only form I could find. The desert area near Gaza is a northward extension of the Sinai desert, an intrusion of a tongue of desert into a more cultivated area.

In 1940 Mr. D. Robson brought back for me a series of shells from Gebel Maghara, in North Sinai (33° 20′ E., 30° 40′ N.), an isolated Jurassic area. Two of these were alive and very fine examples of *fourtaui* (set 433) whilst the remaining 28 (set 447) were a perfect catenation from *fourtaui* to *hemprichi*. So far as I know they were all collected at one spot and I am certain they were not selected. I suggest that here we have an example of crossing in nature of two forms of the *Eremina*-complex, which are very distinct in their characteristics when in their pure form.

INTERBREEDING BETWEEN THE FORMS IN THE *EREMINA* COMPLEX

If my contention is correct, namely that the genus is really a great plastic complex, then interbreeding in nature should take place. This is suggested by the series of shells taken at the points where the area of distribution of the forms impinge on one another and they seem to intergrade. If this is precisely what happens then one should be able to produce these hybrids under laboratory conditions. Accordingly whilst I was out collecting with Dr. Kaltenbach in the desert 9 km. east of Maadi I took one example of *E. ehrenbergi* Roth on a barren hillside. My journal says that we had difficulty in finding living specimens and this one, and one Kaltenbach took a few yards away, were the only living ones seen. The specimen was taken at 2.0 p.m. on 19 November 1938, sealed down fast to a stone. This specimen was placed in a glass jar on the same day with an example of *desertorum* Forskål taken some time before near Cairo on the road from Gizeh Pyramids to Alexandria. Both therefore were most probably not gravid. During the next morning the *ehrenbergi* excavated a large hole and started laying eggs. I believe that the life-processes are quick in deserts and that copulation took place during the night. By that same evening a number of eggs were hanging (rather like a bunch of grapes) from the fore part of the flaccid animal. The process was watched through the bottom of the jar. By the morning of the following day the oviposition was over, the hole more or less covered up, and both snails were in a lethargic state lying beside one another, as I have observed in other snails when copulation has just been completed.

On 27 November 1938 the *desertorum* had excavated a hole during the night and this work seemed finished by 7.0 a.m. At 3.0 p.m. one egg was laid; by 9.0 p.m. there were 10 eggs. By the following morning at 7.0 a.m. oviposition seemed to have been finished, probably during the night, and about 20 eggs were now in the hole. I assume that this may be about the time taken in nature to complete the process of egg-laying. During the night of 9–10 December the *desertorum* excavated an entirely new hole and started egg-laying by early morning ; again 20 eggs were laid, but I have not noted in this case the time taken. I have a note to say that the eggs of this batch are larger than those I measured from the desert near the Gizeh Pyramids, and larger than those laid previously.

On returning from holidays in England about the end of September the following year both these examples were found to be alive and well, but on 12 October the *ehrenbergi* was found to be dead ; as this would conclude the experiment I killed the *desertorum* for my collection.

Now let us go back and consider the fate of the progeny of this cross. On 9 December 1938 40 examples of young snails were found in the jar and transferred to a separate one. During the first half of 1939 these snails died. They are now in my collection numbered 380/A.1.

On 31 December 1938 16 examples were found crawling about the jar and were removed to another jar A.2, but it is quite impossible to say which of the pair laid the eggs. This is unfortunate in view of the importance of this lot. These shells died off until at the end of August 1939 only 4 examples remained alive. Of these 4 only three lived to be of any size. On 26 February one of them, 380/A, died after an accident. On 17 October 1941 the second specimen (No. 380/B) was found to be dead when I watered them to rouse them from aestivation ; it had probably been dead some time as there was little of the animal left inside. I am counting the age of this example to the date when last seen alive, this gives 26 months. The last survivor had to be brought to England, as I myself came home, and it lived until about 1 March 1943, when it died aged 4 years and 3 months. I merely give these dates as they may have some bearing on future investigations with regard to *Eremina*, but living under the conditions imposed upon them they may have taken longer to reach the size they are than in a state of nature.

The last of the hybrids to die (No. 380/C) was fortunately found before it had decomposed and the soft parts were sent to Lt.-Col. A. J. Peile for examination of jaw and radula. Fig. 1 is the sketch he made of the hybrid jaw, together with 3 undoubted *desertorum* I had previously given him. This clearly shows that the diagnostic value of the jaw having three ribs in *ehrenbergi* and two in *desertorum* (see Kaltenbach, 1934, figs. 2 and 4) is not final. At the same time it does not prove which of the two parents laid the eggs from which these last three hybrids developed. With regard to the radula Lt.-Col. Peile writes (*in litt.* 11 April 1943), " I have duly mounted the radula and can see nothing remarkable in it compared with

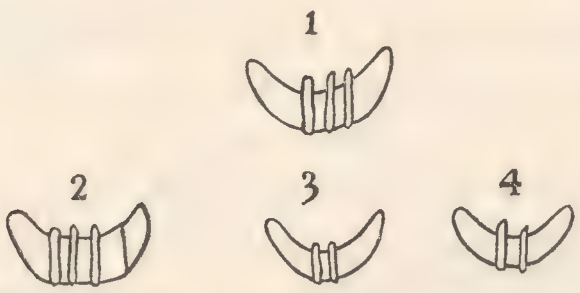

FIG. 1.—Jaws of *Eremina*, 1. Hybrid. 2, 3, and 4. *E. desertorum* Forskål. Desert West of Cairo, *leg*. H. E. J. Biggs. Drawn by Lt. Col. A. J. Peile. Approximate magnification, × 5.

a few *desertorum* (one from your material) and one *ehrenbergi* from your material. Perhaps a little more like the first named in the cusps of the marginals but any difference could be easily accounted for by individual variation. As regards the formulae they are

desertorum	23. 18. 1. 18. 23.	Biggs' material
ehrenbergi	34. 20. 1. 20. 34.	
hybrid	31. 17. 1. 17. 31.	

Here again much would depend on the age of the individual, adults have more lines of teeth than juveniles of the same species." In a postscript to this same letter he writes " The hybrid radula shall go to B.M. with your approval ? ". In a second postscript he says " I failed to find a dart ; presumably the beast was sexually immature ".

Further experiments and efforts to persuade the two species to mate in captivity were as follows. On 22 November 1938 one *ehrenbergi* and one *desertorum* both from near Bir Gandeli were segregated in a jar. I took these because they were both from an area where I believe hybridisation takes place in nature. These having been 4 days in captivity were not likely to have been fertilised in nature before capture, for if they had been, egg-laying following as it does so rapidly on copulation, I should have seen this take place. These were given the letter C. On 25 November the *ehrenbergi* was seen at 7.0 a.m. hanging loosely in a hole it had excavated on the night of 22 November. At 8.10 a.m. it was still motionless but three eggs had been extruded. By 7.0 p.m. the process was over and some 25 to 30 eggs were observable. All these eggs developed but the young failed to escape from the hole. As there was no further activity the pair were separated on 19 December.

Pairs lettered B, D and E failed to copulate. Pair G was a fortuitous mating. In a box I had a number of white *desertorum* and one juvenile maculated example. I also had a series of snails which Pallary had determined as *desertella* Jickeli. Under the impression that they were different species I allowed one of this latter series into the box, where it " chose " the juvenile example of *desertorum*. I suspected that the *desertella* was merely a form of *desertorum* and Lt. Col. Peile later confirmed my opinion. *E. desertella* Jickeli, if an *Eremina* at all, is an Abyssinian species. This mating took place on 17 December 1939 at 1.30 p.m. ; the pair were immediately isolated in a jar and at 2.45 p.m. the coitus was over. I think the " *desertella* " was acting as male. On the night of the 18–19 December the *desertorum* dug a hole and 25–30 eggs were seen and counted through the glass bottom of the jar. I decided to kill the pair for my collection ; I regret to say nothing came of this mating as the eggs failed to develop, but before killing them I placed the " *desertella* " in a jar with another *desertorum*. For some days nothing happened, then in order to clean the jar I removed the pair and put them in the stock box of white *desertorum* mentioned above. Immediately the " *desertella* " copulated with one of the others. It should be noted that this " *desertella* " had two opportunities of copulating in the stock box of *desertorum* and it mated. When segregated in the jar together with one it had not selected no mating took place. I suggest that there is something ultra-physical which prevented the copulation of this example with one of an exactly similar batch of snails. Here is a problem that needs investigation.

Dr. Cain (1959) in experimenting with *H. striolata* (C. Pfeiffer) isolated a number of pairs in separate boxes but only one pair copulated. Dr. Emilia García San Nicholás (1957) in crossing *Iberus gualterianus* with *I. alonensis* only describes and figures one shell, and that an immature one. If she had had more success one would have imagined she would have figured an adult example (pl. 6, figs. 44 a and b). May there not be here a very interesting line of investigation for students of the Mollusca ?

CONCLUSIONS

Deserts are centres of intensive evolutionary activity and in them life is difficult, hence only Molluscs which are plastic and able to change fairly rapidly can survive.

This plasticity operates also in forming variants which apparently have no particular purpose, but are not detrimental to the forms in the group *Eremina*. In view of the great amount of grading between one form and another, we should consider *Eremina* as a complex.

The striking parallelism between the catenation between *Eremina ehrenbergi* s.s. and its local race *zitteli* with the catenation between *Iberus alonensis* and *I. gualterianus* should be investigated further, and it is suggested that the best result would be if a worker in Spain and another in Egypt could co-operate.

There is an ultra-physical factor governing the mating of snails in captivity, which factor may operate also in nature. Until more is known of this perplexing problem, extensive breeding experiments will remain difficult and rather disappointing.

Finally, we are here dealing not with a static genus but a group of snails which are plastic, actively evolving here and now. It is suggested that figure 2 might be a basis for a diagrammatic expression of the present state of evolution.

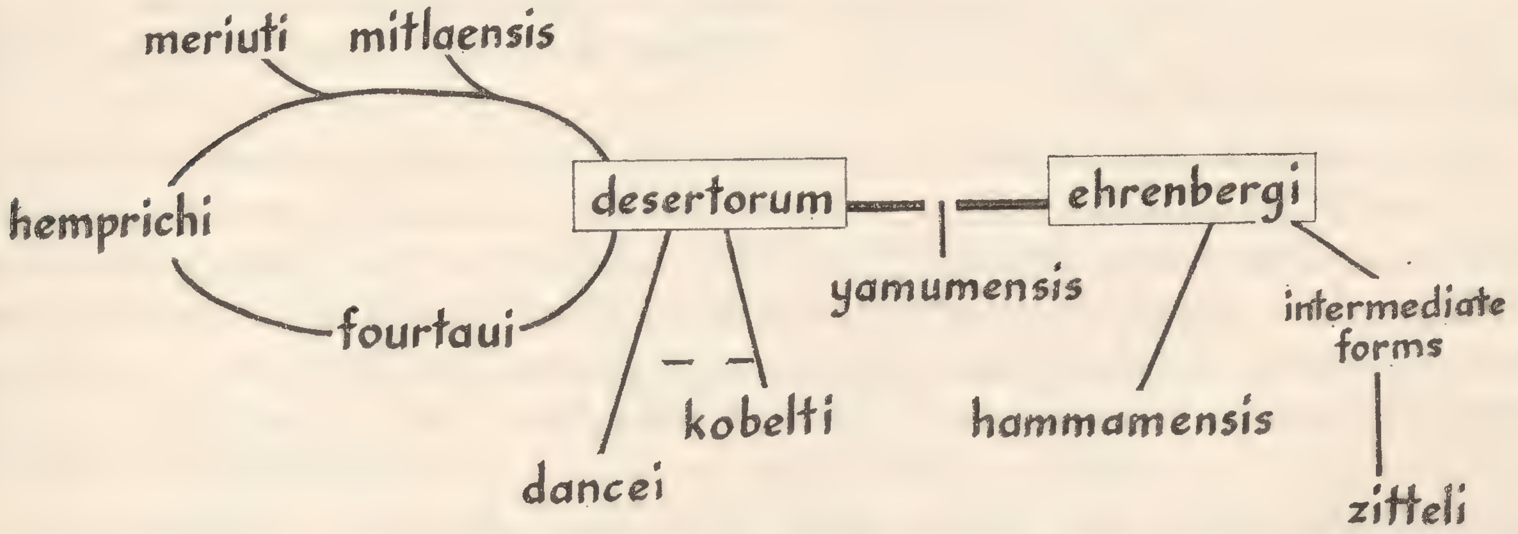

FIG. 2.—Diagram of present evolutionary position of some forms of the *Eremina* complex in relation to the basic species.

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SOME LAND MOLLUSCA FROM NORTHERN IRAQ

By Rev. H. E. J. BIGGS, F.L.S.

(*Read before the Society, 14 March 1959*)

LITTLE has been written on the land Mollusca of Iraq. The most important contribution was that of Pallary (1939), who described the Macfadyn collection in the British Museum in his work. Germain (1921) made occasional reference to Iraq in his work on the Mollusca of Syria. More recently Dr. Fritz Haas (1952) has published a short list of species with localities from this area.

Mr. Stuart A. Harris has submitted to me his collection from northern Iraq and Miss Maitland Howard a small, but interesting, series she had collected. The fact that Mr. Harris was working on problems connected with the soils and geology of the area and Miss Howard on archaeological work accounts for the paucity of live specimens, but such as there were in the collections have proved useful. In one case it has given opportunity for Dr. Quick's valuable contribution (p. 347). It should be noted that in the cases where only dead shells have been found, it should not be assumed that the species still exists in the area, although there is obviously a strong presumption that this is the case.

I am grateful to Miss Howard and Mr. Harris for allowing me to examine their material, and I must also thank Dr. Lothar Forcart and Dr. E. Binder for checking over some of the species which, to me, were difficult to identify with any certainty.

Oxychilus jebusitica (Roth).

A few dead shells collected by Miss Maitland Howard on the banks of the Great Zab river near Nimrod, one dead shell from near Kirkuk and a second from Zara Touka, 7 km. along the road towards Sarsang, are all the examples of this species I have seen from Iraq. It must be a fairly rare snail. One does not associate this genus, and its near relatives, with desert areas, and it may be that we have here a species nearing extinction in a terrain in which the struggle for existence is so great.

Hygromia limbata (Draparnaud).

One dead shell collected by Miss Howard at Maltai. This is the first time the genus has been recorded for Iraq and I think also the most easterly known locality for the species.

Helix (*Helicogena*) *salomonica* Naegele.

I record localities from which Harris has sent shells similar to Naegele's *salomonica* : 4 miles west of Erbil ; 5 km. from Zara Touka ; 9 km. east of Dohuk ; 800 m. inside the Rowanduz Gorge from the east end ; Koi Sanjaq ; south and north of Kirkuk ; Jujar village. Miss Howard collected it at Nimrod and Maltai.

Xerocrassa seetzeni ([Koch] L. Pfeiffer).

Localities where it was collected by Harris : Tauq Bridge, 1 km. east of the bridge ; Tauq Chai, south-west corner of the railway viaduct ; 5 km. north-west of Tauq along the road to Kirkuk in a fallow field (in this series there was one living snail) ; 6 km. from Jebelia ; Diyala, north end of Diyala Weir ; Tauq, near the junction of Tauq Chai and Zigutun Chai, many examples collected but only one was alive ; on the Quri Chai, near the junction of that river and Wadi Azaza, 234 examples collected. Of this last fine series about 16 appeared to me to be alive, so that I was able to preserve some animals for future work. The jaw was extracted from others. Many others had the usual white epiphragm used to conserve moisture during the hot summer, and they contained some remains of the soft parts. I was able to keep some of these snails alive for a short time ; they were very shy and the slightest jogging of the bench, or shadow of the hand falling near an extruded animal, was sufficient to make it retire at once to its shell.

Furthermore this long series from one locality in what must be the northernmost limit of the range of the species has given an opportunity of calculating the incidence of varieties in coloration. Whereas in the more southern limit of its range, around the Dead Sea, the variety *fasciata* Mousson is fairly common, in this series it constitutes about 1·2 per cent. In 11 per cent of this series there is some trace of maculations on the upper whorls ; the rest are completely white.

Xerophila langloisiana (Bourguignat).

Xeroleuca macfadyeni Pallary, 1939, 29.
Xerotropis palmyrensis Pallary, 1939, 34.

Localities collected by Harris: 5 km. north-east of Chemchmal, 22 dead shells; 800 m. north of Nehasia on the Taktak to Kirkuk road, 9 dead shells; Mahmour village, Jebel Qara Chouq, one dead shell; 1 km. from Kirkuk on the road to Erbil, one dead shell; 5 km. south of police station at Dadad, on Kirkuk to Taktak road, 4 dead shells. This species was originally described from near the Dead Sea. I have carefully compared all Harris's specimens with Pallary's types in the British Museum and have no doubt that they are the same species. It is possible that the Dead Sea is the southern limit of distribution for this species and therefore there may be a slight variation. Further collecting will probably reveal the fact that this species is very widespread.

Xeroplexa ?kotschyi (Pfeiffer).

The following examples collected by Harris are temporarily referred to this species: Tauq, 1 km. north-east of Tauq Bridge and on the south side of Tauq Chai; Chemchemal, 14 km. from Chemchemal towards Suleimaniyeh; Nimrod, in bricks from the Assyrian town of about 800 B.C. A few dead shells in the first two cases and 16 examples in the bricks. These shells are very similar to those I collected in the Zagros Range in southern Persia under stones in the Dukhtar Pass west of Shiraz.

Xeropicta derbentina (Krynicki).

This species was probably the most common collected by Harris. It occurred at the following places: Aqra, Rowanduz Gorge, Zara Touka, Koi Sanjaq, Chemchemal, Halabje, Tasulja, Tauq, Mosul, Nimrod, Dohak, Galala, Kirkuk, Arbet and Bei Hassan. In most cases the shells were dead and collected in large numbers. Amongst them were a few living snails, the bodies being preserved in my collection.

Some of the specimens collected by Harris are rather difficult to place. *X. derbentina* (Krynicki) is dominant in Asia Minor, *X. vestalis* (Pareyss) L. Pfeiffer and its coastal form *joppensis* (Roth) are dominant in Syria and Palestine, especially the latter. It is not to be wondered at that collections of *Xerophila* from northern Iraq, and indeed the whole of Iraq where it occurs, should be a little difficult to place exactly. My present feeling is that *X. vestalis* is not nearly so widespread in northern Iraq as is generally supposed.

Levantina guttata (Olivier).

From the limestone hills above the river Tigris, 7 km. south of Mosul, come 2 examples which should probably be referred to this species. Unfortunately both are dead, so no evidence from the animal can be deduced. The structure of the protoconch, however, would seem to place them in the group to which *L. guttata* belongs.

Levantina mardinensis Kobelt.

One example collected by Miss Howard near Maltai in 1956.

Levantina kurdistana ([Parreyss] L. Pfeiffer).

L. macfadyeni Pallary, 1939, 24.

Koi Sanjaq, 4 dead shells from 4 km. west of the place and from 15 km. south-south-west many dead shells (this locality is on the road to Taktak); Tasulja, 1 km. east and on the Chemchemal–Suleimaniyeh road, 4 dead shells and some juveniles: these are the largest taken by Harris, the average width and height being 40·2 mm. and 24·4 mm. respectively; Sarsang, one dead shell on the north slope of wooded hills; Aqra, several dead shells on a hillside; Mosul–Aqra road, 8 examples much smaller than normal: of these one measures 28 × 20 mm. and the other 27·7 × 19·6 mm. On an escarpment south of Bei Hassan Harris collected several snails, and of these three are now in my collection; two contained remains of the body and one was alive, this being the subject of the anatomical work of Dr. Quick. They are globose, but must be included under this species on account of the structure of the protoconch. Near Chemchemal going towards Suleimaniyeh Harris made a collection of dead shells which are a good average for the species, i.e. height 21·4 mm., width 34·7 mm.

Some of the most interesting examples of this species I have were collected by Miss Maitland Howard in 1956 near the Zab Tunnel on the Great Zab river; they are very small and at first I thought they were *L. dschulfensis* Bourguignat. Two were alive, and the two smallest measured 26·1 × 17·3 mm. and 27·5 × 16·6 mm. They are the smallest of the species I have seen so far and may merit a varietal name.

Levantina sp.

Just inside the Rowanduz Gorge, and 800 m. from the eastern end, Harris collected a short series of shells of a species of *Levantina*. The shells are very large, the largest measuring 43·1 × 23·3 mm., and are said to come from a wet and shady place on limestone, which may account for the size. Unfortunately these examples were all dead and entirely white, hence my hesitation in referring them to any described species.

Monacha schotti ([Zelebor] L. Pfeiffer).

Harris's records are:—near Touq (about 280 examples); Kirkuk, various localities around the town; near Ctesiphon (3 examples). Unfortunately of these hundreds of examples none was alive. Miss Maitland Howard has collected the species on the banks of the river Tigris near Nimrod and near the Zab Tunnel.

Germain (1921, 207) reports Mousson as mentioning the abundance of *Monacha obstructa* (Férussac) in Mesopotamia. Amongst the series of *Monacha* I have seen from Iraq I cannot help feeling that some at least should be referred to *obstructa*, in fact *obstructa/schotti* catenations could be made from the collections made by Mr. Harris and Miss Howard.

Petraeus halepensis ([Férussac] L. Pfeiffer).

This very widely distributed species was taken by Harris in the following localities. Koi Sanjaq, Tasulja, Tauq Bridge, Kelek, Halabje, Kirkuk, Aqra, Zara Touka, Mosul, Arbet, junction of Quri Chai and Wadi Azaza. Miss Howard secured the species near Nimrod, by the Great Zab river. This species was collected in quite large numbers, but there was not a living specimen amongst them. They vary much in size and general shape, so that some may have to be referred, later on, to one or other of the forms of this species already described.

var. *libanotica* Neagele.

Mosul, on limestone hills 7 km. south of the town, 2 dead shells, and 24 km. from Arbet, 2 dead shells.

Zebrina caesia (O. Boettger).

One example of this species found amongst a large number of mixed shells of *P. halepensis* and *L. kurdistana* taken on the road between Mosul and Aqra. It is interesting to note that this shell agrees more closely with the form from western Turkey than with var. *armenica* Naegele.

Chondrula isseliana (Bourguignat) Issel.

One dead shell 56 km. from Koi Sanjaq towards Erbil.

Chondrula iraqensis Pallary.

One example 4 km. from Halabje on the Kurmal road ; two examples near Rowanduz (all dead shells). The Halabje example measures 11 × 4·6 mm. and the smaller of the other two 7·5 × 3·7 mm.

Jaminia septemdentata (Roth) var. *triticea* Rossmaessler.

By the kindness of Professor R. J. Braidwood of the Oriental Institute, Chicago University, I have been able to examine the shells collected by the Iraq-Jarmo project. These have been determined by Dr. J. Bequeart. Amongst them are a few examples of the above named shell from a stratum said to be between 10,600 and 9,500 years old, although one of them looks as if it were but recently dead. It is a known fact that shells can be of very considerable age and still retain their lustre. However, I feel that this record should be included in a paper on the recent shells of Iraq in order to stimulate search for the species alive to-day.

Orcula iraqensis Pallary.

Three examples were collected by Miss Maitland Howard in 1956 at Maltai, and a very small specimen was taken on the bank of the river Tigris about the same time. A fourth example, also from Maltai, must be referred to var. *porrecta* Pallary.

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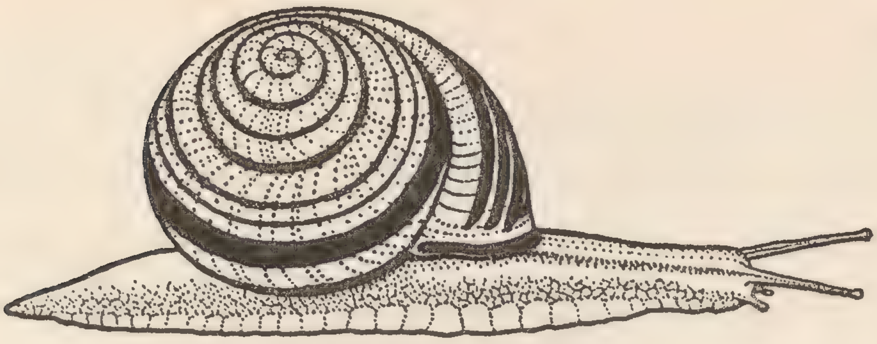

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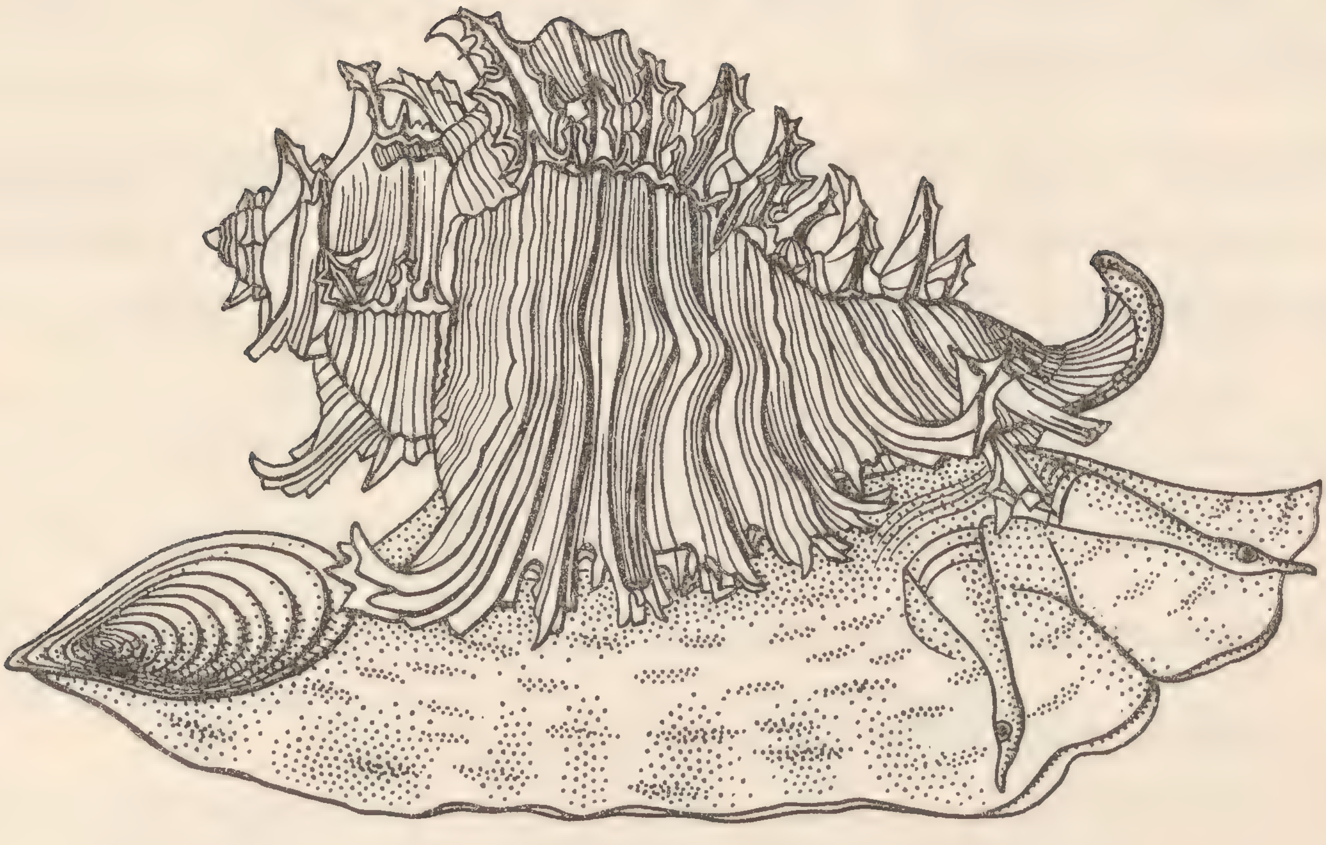

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COVER DESIGN by Miss J. Webb.

Upper Figure (*del. ad nat.*) : *Helix* (*Cepaea*) *nemoralis* Linné

Lower Figure (after Kiener) *Chicoreus ramosus* (Linné)

THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND

The aim of the Society is to promote the study of Mollusca, marine and non-marine, British and foreign, living and fossil.

The Society caters essentially for the amateur and special attention is paid to the study of the natural history and distribution of British Mollusca.

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RULES

OF THE

CONCHOLOGICAL SOCIETY

OF

GREAT BRITAIN AND IRELAND

(As amended at a Special General Meeting held on February 16th, 1952)

1.—The Society shall be called "The Conchological Society of Great Britain and Ireland".

2.—The object of the Society shall be the promotion of the study of Mollusca in its widest aspects.

3.—The Society shall consist of Honorary, Life, and Ordinary Members.

4.—Ordinary Members shall be proposed by two members at one meeting and balloted for at the next. They shall pay an entrance fee of Ten Shillings and One Pound subscription on election and, in advance on January 1st in each year, a subscription of One Pound, or such sum as the Society at a Special General Meeting may hereafter from time to time determine; they may compound for Life Membership by the payment of Twenty Pounds. If on December 31st of any year, a member shall be two or more years in arrear with his or her subscription, the Council may erase his or her name from the list of members and may take whatever steps seem desirable for the recovery of the arrears. No Member shall be eligible to vote or to receive the Journal who has not paid the current year's subscription or any arrears for which he or she may be liable.

5.—Composition Fees shall be invested in a Life Membership Fund.

6.—The number of Honorary Members shall be limited to ten and they shall be exempt from all payments and have the privileges of Ordinary Members.

7.—The Society shall be governed by a Council, consisting of a President, Vice-Presidents, Secretary, Treasurer, Editor, and six other members, who shall be elected annually by ballot; the voting paper issued to be returned to the Secretary, under cover of sealed envelope addressed to the Scrutineers. More than one office may be held by one person.

8.—The Presidency shall not be tenable for more than two years in succession and the President is expected to give at least one address. On the conclusion of his term of office he shall become an *ex officio* Vice-President of the Society and an *ex officio* member of the Council.

9.—The meetings of the Society shall be held at such time and place as the Council shall determine.

10.—Three shall form a quorum at all meetings.

11.—The Annual General Meeting shall be held at such time and place as may be fixed by the Council to receive and, if agreed, adopt the Reports and Balance Sheet of the out-going Council and to elect a Council and Officers for the ensuing year.

12.—The accounts, before being presented, shall be audited by two members appointed at the previous Annual General Meeting.

13.—The Journal shall be published periodically under the direction of the Council, whose decision concerning publication shall be final

14.—The Capital and Property of the Society shall be vested in two Trustees, elected by the Society.

15.—No alterations in the rules shall be made, unless by a majority of three-fourths of the members present at a meeting which has been specially summoned.

The Annual Subscription is One Pound due on January 1st in each year.

Caecilioides sp.

Miss Howard took 36 examples of a *Caecilioides* in wood of the Balawat gate of the Temple of Mamu. It has so far been impossible to determine to what species these shells, the first of the genus ever to be discovered in Iraq, are to be referred. It may be that there is more than one species here. One which is about double the length of the average for the others is either a second species or a very abnormal shell. In view of the fact that all were obtained in the one gatepost it seems probable that we have here one very variable species, again illustrating the " plasticity " of desert species. In washing the earth from a long series of *Monacha schotti* taken by Harris from the banks of irrigation ditches near Touq I came across three examples of this species. Two of these are of average size but the third is noticeably larger. These three examples are now in the collection at the British Museum. As this latter locality is well over 100 miles from Miss Howard's it seems as if the species is widespread.

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APPENDIX

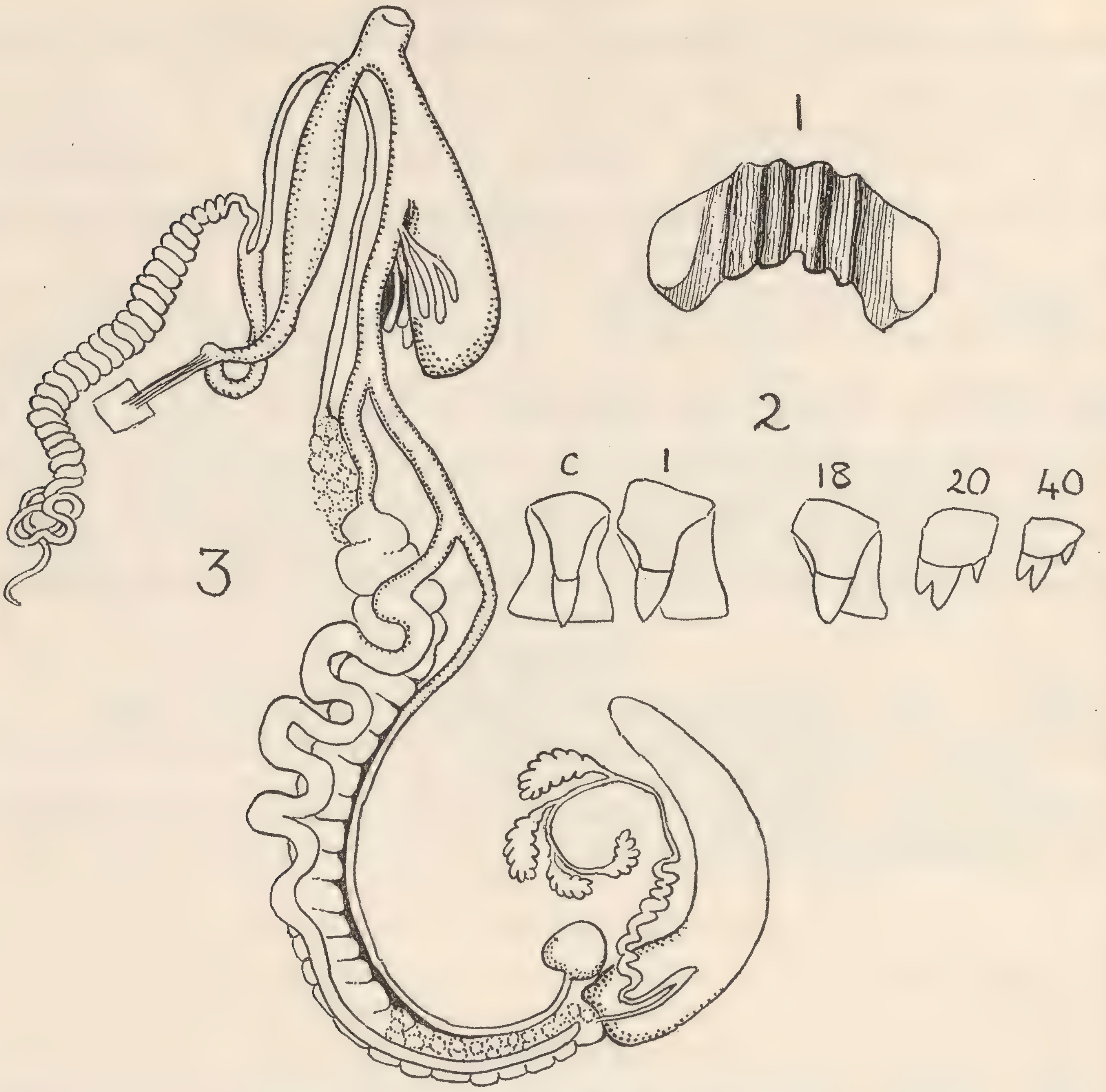
LEVANTINA KURDISTANA (PARREYSS) L. PFEIFFER

By H. E. QUICK

THE golden brown jaw, Fig. 1, measures 2·2 mm. from side to side and is crossed by four strong ribs which denticulate the upper and lower margin.

The radula, Fig. 2, is noteworthy for the complete absence of ectocones on the rachidian teeth and of endocones and ectocones on the lateral teeth. In the marginal teeth, what seems to be the mesocone becomes bifid and an ectocone appears. There are about 145 transverse rows of teeth. The count in the specimen examined is 28.18.c.18.28. × 145.

In the genital system, Fig. 3, the vaginal mucous glands are greatly reduced in size and number, having only two or three short tubules on each side, and so contrast strongly with the long and luxuriantly branched glands of *Eobania vermiculata*. The spermathecal duct at its origin is wider than the oviduct at that point, and soon bifurcates into a slender spermathecal duct proper and a wider caecal diverticulum. In *Eobania*, however, this diverticulum is even stronger. The male organs are mainly notable for the extremely long and tightly coiled flagellum, of which only the beginning and end are loosely coiled or straight. In *Eobania* the flagellum is much shorter and not coiled.



Levantina kurdistana L. Pfeiffer

FIG. 1.—Jaw. × 11.
FIG. 2.—Representative teeth from the radula. × 250.
FIG. 3.—Genital system. × 3.

The eggs of *Vitrina pellucida* (Müller).—On 1 January 1959 in the vicinity of Redgate Wood, near Kirklington, Notts., I inspected some snail traps consisting of pieces of dead elm bark, which I had put down some time previously. Under one piece of bark I observed a single specimen of *Vitrina pellucida*. The animal was extended in a peculiar manner, the forepart of the snail being hidden from view in a small hole in the ground about one-eighth of an inch in diameter. Gripping the shell I gently lifted the snail, and when the forepart came into view I saw a cluster of five roundish white eggs attached by a thin mucous thread to the snail, and another egg could be seen half expelled from the snail. The eggs measured approximately 1·5 mm. in diameter. Whether the snail would lay any more eggs after it was released and the bark replaced I cannot say.

G. W. PITCHFORD.

(*Read before the Society, 17 January 1959*)

OPERCULA OF CALCITE IN THE BITHYNIINAE

By Dennis Curry

(*Read before the Society, 17 January 1959*)

In the course of a recent search for microfossils in the Reading Beds (Palaeocene), samples were collected from the well-known section in the disused quarry of the Associated Portland Cement Company at Harefield, Middlesex. In this quarry, at about six feet above the base of the Reading Beds, there is a lenticular patch of grey sandy clay which contains a fair number of impressions of leaves and is therefore called the leaf bed. About 10 kilogrammes of this clay was washed. It yielded a small number of fossils in the state of internal moulds in limonite of small gastropods, ostracods and fruits of *Chara*. A few fragments of fish bone were also present. Finally there were some fossils of carbonate of lime. These included a very few *Chara* fruits, some Foraminifera derived from the underlying Chalk and a quantity of gastropod opercula. It is these opercula which form the main subject of this note.

The opercula, which occur at the rate of about five per kg. of sediment, are hard, translucent and of the same shape as those of the recent *Bithynia tentaculata* (L.). The largest of them is, however, only 3 mm. in its greatest dimension, compared with about 5 mm. for that of an adult *B. tentaculata*. Although the shape of the fossil is the same as that of the recent form, the two can readily be distinguished because the pattern of growth lines on the outer surface in the two cases is different.

During its growth, the operculum may rotate. In *B. tentaculata*, as in most species of *Bithynia*, this rotation is almost imperceptible except in the earliest stages and the pattern of growth lines appears roughly concentric. In the fossil species from Harefield rotation is appreciable throughout life. In doubling its linear dimensions it rotates through about 60°. As a result of this more rapid rotation the basic concentric design becomes somewhat obscured and a spiral pattern predominates. I have been unable to find any recent *Bithynia* with such a strong spiral pattern, although certain members of the Hydrobiidae (e.g. *Stenothyra strigulata* Benson and *Pomatiopsis fusca* Ziegler) possess uncalcified or partially calcified opercula similar in pattern to that of the fossil. A few recent species of *Bithynia* do show appreciable rotation during life. These include *B. striatula* Benson and *B. alberti* Smith, but in none of these is the rotation as rapid as in the fossil.

It seems probable that the fossil opercula are of a species which was related to the Bithyniinae and the occurrence in the same bed with them of other fossils indicating continental conditions is consistent with this view. This bed, however, yields no calcareous gastropod shells, although it does contain internal casts of the shell of a mollusc to which the opercula might have belonged. Why are the opercula preserved when the shells have apparently been destroyed? It seemed that a possible reason for this might lie in the mineral composition of the two and that while the shells were, as usual in gastropods, of aragonite, the opercula might be of calcite. It is well known that under certain conditions the aragonite in fossils has been completely removed while the calcite remains unaltered.

Specimens of the opercula were therefore submitted for examination by X-ray diffraction, together with specimens of the shell and operculum of *B. tentaculata* for comparison. These latter were from a Pleistocene gravel from Willment's gravel pit, Isleworth, Middlesex. The tests revealed that while the shell of *B. tentaculata* is of aragonite, the operculum of *B. tentaculata* and that from the Reading Beds are of calcite. The case of *B. tentaculata* appears to be the first in which a gastropod is recorded as having a shell of aragonite and an operculum of calcite, although a similar phenomenon is well known among ammonites. The calcareous opercula of all the Bithyniinae examined by me are similar in appearance and it is probable that they are all made of calcite. If this supposition is confirmed, it would suggest that they have all been derived from a single stock with an uncalcified operculum. As most calcified gastropod opercula are of aragonite, it seems that calcified opercula have been evolved independently in gastropods on more than one occasion.

I am very grateful to Dr. G. F. Claringbull and members of his Department at the British Museum (Natural History) for having carried out the mineral determinations mentioned above.

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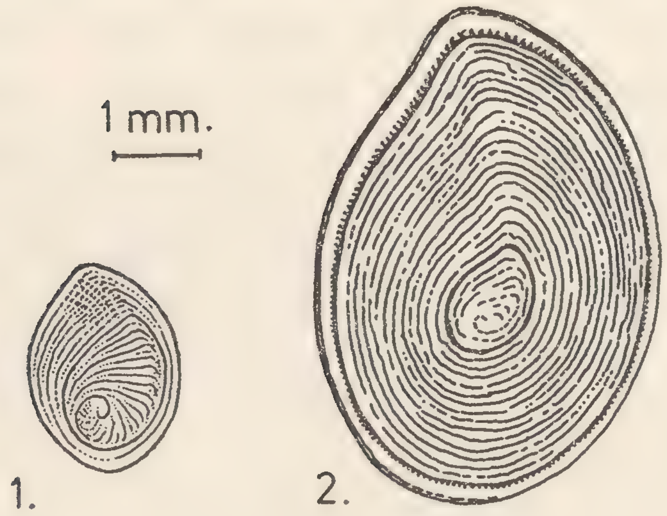
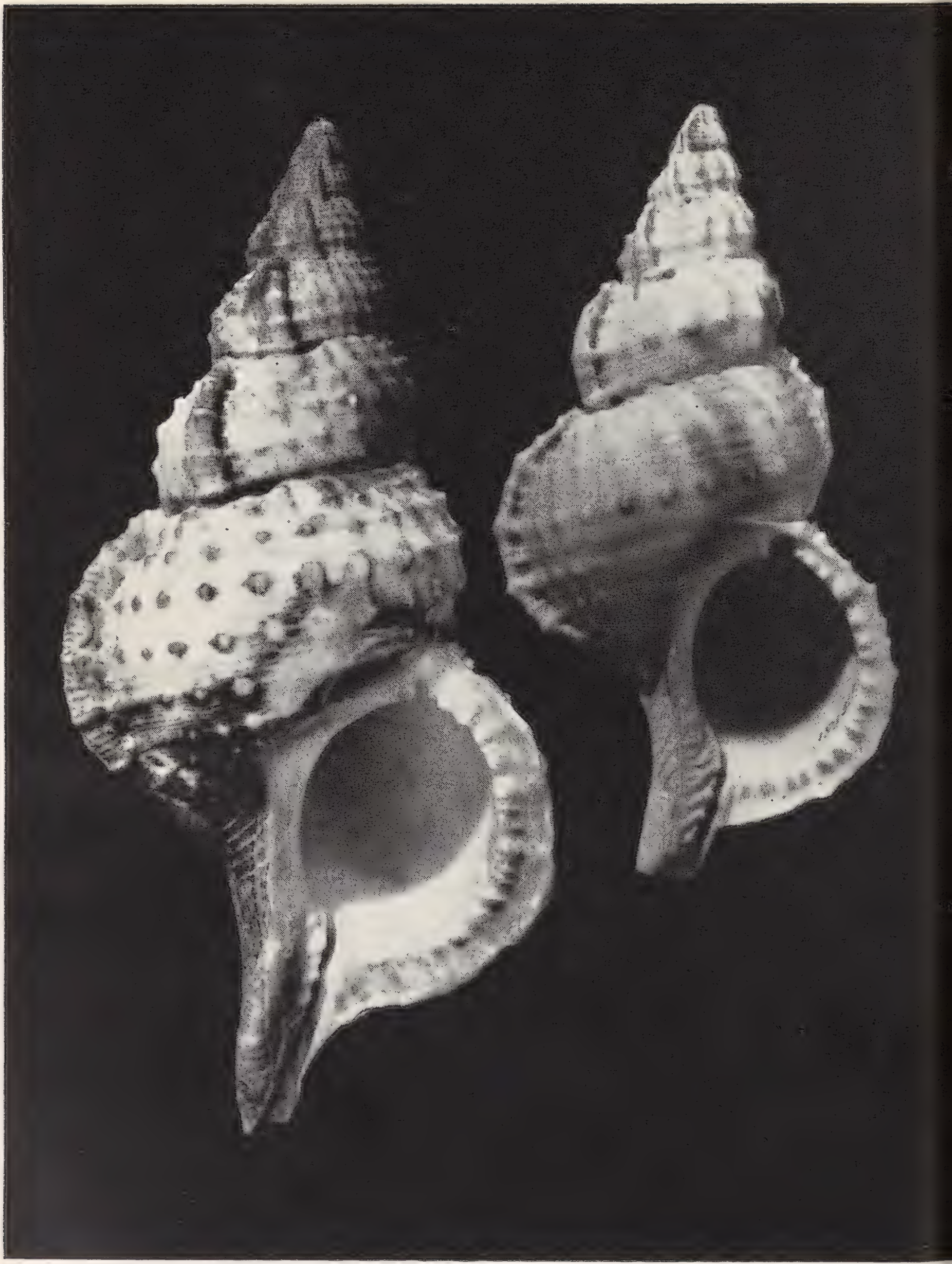


Fig. 1.—?*Bithynia* sp. View of outer face of operculum. Leaf Bed, Reading Beds, A.P.C.M. quarry, Harefield, Middlesex. British Museum (Natural History) G88660. × 6.

Fig. 2.—*Bithynia tentaculata* (L.). View of outer face of operculum. Pleistocene gravel, Willment's gravel pit, Isleworth, Middlesex. British Museum (Natural History) G88663. ×6.



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Gyrina gigantea (Lamarck)

[*Facing p. 351*

GYRINA GIGANTEA (LAMARCK), AN UNEXPECTED ADDITION TO THE SOUTH AFRICAN MARINE FAUNA

By S. P. DANCE, Department of Zoology, British Museum (Natural History)

(*Read before the Society, 9 May 1959.*)

THE deeper waters around the South African coast harbour an abundance of unusual and striking molluscs. The discovery of the beautiful *Pleurotomaria africana* Tomlin (*J. Conch.* **23,** 2, pl. 1) in deep water off Durban in 1933 is an indication of the unknown richness of this marine province. Through the kindness of Mrs. Boswell of Johannesburg and Dr. J. S. Pringle, Director of the Natal Museum, Pietermaritzburg, I have been able to examine a number of specimens trawled off the Natal coast recently, among them a large series of a species new to the province, though well known from deep water in the Mediterranean and north-eastern Atlantic.

A series of large gastropod shells was received in 1958, all taken in crawfish nets at a depth of 160–180 fathoms about 10–20 miles off the mouth of the Tugela River, Natal. I am assured that most of them contained the living animal when taken and several were received with operculum, while one retained traces of the soft parts in the apical whorls. The operculum is present in one of two similar shells (said to be from Natal waters, but without more precise locality data) that have been stored for many years in the Natal Museum.

Both Dr. Pringle and Mrs. Boswell had noticed the resemblance of these shells to *Gyrina gigantea* (Lamarck) (= *Ranella gigantea* auctt.), and comparison with specimens in the British Museum (Natural History) indicates that, on the characters of the shell and operculum, they must be referred to this familiar Mediterranean species. They closely resemble the thickened form of the species characteristic of the Atlantic, in which the tubercular processes adorning the whorls, especially the last, are often very prominent.

G. gigantea is known from the Mediterranean, where it is widely distributed, and from a number of stations in the north-eastern Atlantic (Locard, 1897, 296). To the west it extends as far as the Azores (Dautzenberg and Fischer, 1896), and reaches its northern limit off the south coast of Ireland (Cooke, 1916). Shortly after this paper was read I was informed (Dr. J. Knudsen and Dr. W. Adam *in litt.*, 6.v.1959 and 22.v.1959) that *G. gigantea* was collected alive in numerous stations off Angola, in deep water, by the Belgian Oceanographic Expedition (1948–49). The South African record thus seems to be a logical extension of its range southwards. It is a Miocene and Pliocene fossil in Europe (Locard, 1897).

This extension of the known range of *G. gigantea* into South African waters is a striking parallel to that of *Eudolium crosseanum* (Monterosato), recorded from 310 fathoms off the Buffalo River, some 300 miles west of the Tugela River (Tomlin, 1927). Dr. Barnard tells me (*in litt.*, 20.v.1959) that there are examples of *E. crosseanum* in the South African Museum from Cape Vidal, Zululand, 80–100 fathoms, and from north of Durban off the Umhloti River, 40 fathoms. Like *G. gigantea*, this species has been taken in deep water off Palermo, Sicily, and the Azores ; it is also recorded from a number of stations in the West Indies and off the Atlantic coast of North America (Locard, 1897, 294). It will be most interesting, therefore, to see if *G. gigantea* turns up in other deep water stations further east or west.

I am grateful to Dr. K. H. Barnard of the South African Museum for his comments during the preparation of this note.

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Explanation of Plate 9

Gyrina gigantea (Lamarck), natural size.

FIG. 1.—Natal, South Africa, off Tugela River, 160–180 fathoms.

FIG. 2.—Southern Ireland, off the Saltees lightship, between Carnsore Point and St. David's Head, 50–100 fathoms.

Photographs by permission of the Trustees of the British Museum (Natural History.)

INHERITANCE OF MANTLE COLOUR IN *HYGROMIA STRIOLATA* (C. PFEIFFER)

By A. J. CAIN

(Read before the Society, 17 January 1959)

IN a previous communication I have described a well-marked polymorphism in this snail, the shell being either red-brown or fawn, and the mantle either heavily spotted with black or very lightly spotted, there being few intermediates in large samples. It was remarkable that there was a very strong tendency for dark bodies to be in red-brown shells, and light bodies to be in light shells, in the colonies investigated.

In July 1957 I collected many half-grown individuals from the colony near East Ilsley (Berks) and set them up as mating-pairs in plastic boxes of the type sold as lunchpacks. The floor of each was covered with damp paper, and the snails were given lettuce, carrot, bran and some powdered chalk. They ate mostly the paper. Of the few that became mature (about early April) only one pair laid eggs, two clutches of 48 and 109, first noticed in the box on 6 September 1958. The smaller clutch came to nothing, but most eggs in the larger one hatched and 33 survived to scorable size, of which all but one are now alive and growing well. The largest are nearly 5 mm. in diameter, and most of the rest only a little smaller. This was about the size of their parents when taken from the wild. The boxes having been kept in a warm room, both the parents and the offspring have fed continuously irrespective of season, and these rates of growth may be greater than those found in the wild.

This family of 33 was produced by a parent with pale body and pale (fawn) shell and one with dark body and pale shell. The offspring fall into two sharply defined classes, with no trace of intermediates, one like one parent, the other like the other, the actual numbers being 21 dark-bodied and pale-shelled and 12 light-bodied and pale-shelled. This interesting result shows at once (i) that the mantle-colour is genetically controlled, (ii) that the two main classes of it observed in random samples from the wild correspond to the effects of a major gene-difference (producing darks or lights) and (iii) that the genes controlling body colour are not those controlling shell colour, since here we have a clear-cut difference in body colour accompanied by no difference in shell colour. This means that the suggestion made in the previous paper, that the abundance of only two classes out of the possible four in the polymorphism (namely dark body and dark (red) shell, and light body and light shell, the combinations dark body and light shell and light body and dark shell being very uncommon) is due to selection acting on linkage between the genes controlling body colour and those controlling shell colour is almost certainly correct. The effect of close linkage is to tie together the effects of different genes in various combinations, and then selection can act upon these combinations almost as though each were caused by a single gene. Animals carrying the combination dark body and dark shell, for example, can be favoured, and will always hand on dark shell together with dark body. When an animal is trying, so to speak, to fit in with its background, this device means that useful combinations of characters can be selected for without being broken up by random assortment of the characters in every generation.

The observation of only two classes in this family, which are exactly like the parents, makes it almost certain that one parent was heterozygous for body colour, carrying the factors for both dark and light, while the other was pure-bred (homozygous) for one or the other shade ; and that one of the two factors is dominant to the other. This is the usual mating to produce from different parents two classes of offspring differing in the same way. Unfortunately this mating does not allow us to decide *which* colour, dark or light, is dominant to the other, since the same result would be produced either way.

This family has been reported on both because the genetics of polymorphisms are of great evolutionary interest, and because it shows how much information can be got out of a single breeding experiment. It is clear from the information given above that the best technique for rearing these animals has not yet been found (or alternatively, that there is much mortality, which may vary from form to form, an exciting possibility), but perhaps other members of the Society have far more experience than I have, and can advise on how to make the best of what is obviously likely to be a most useful species for both breeding and field work.

AGRIOLIMAX CARUANAE POLLONERA NEW TO IRELAND

By P. Makings, Department of Zoology, University of Birmingham

(*Read before the Society, 14 March 1959*)

Collections of slugs from the gardens of University College, Cork, were made recently and every collection included a number of specimens of *Agriolimax caruanae* Pollonera, as described by Quick in his synopsis of the British slugs (1949). Dr. Quick kindly examined a number of specimens which were sent to him and confirmed their identity. There are no previous records of this species from any part of Ireland (Ellis, 1951, and Quick; Ellis, personal communications). In order to obtain some indication of the distribution of *A. caruanae* in the neighbourhood and its abundance as compared with the other species, collections were made in several other localities as well as the College grounds, using various techniques.

The first collections of slugs were taken during the day from beneath seed boxes, plant pots and in similar places in the College gardens, in Cork City. The method was to collect all the slugs found in a particular area or locality until a hundred or more were obtained. Following the original discovery of *A. caruanae* in the first few collections from the College gardens, it was looked for elsewhere and two more techniques were used. These were night-collecting of active slugs; and brief searches for *A. caruanae* at selected places by the roadside. The technique used for night-collecting was that described by Barnes and Weil (1944).

Day collections were made in the College gardens in July and November 1958 and night collections were made in September and November. In addition to *A. caruanae*, the following species were represented in every collection: *Arion hortensis* Férussac, *Milax sowerbyi* (Férussac), *Milax budapestensis* (Hazay) and *Agriolimax reticulatus* Müller. *Arion subfuscus* (Draparnaud) and *Arion ater* (L.) were absent from only one (day) collection, while *Arion circumscriptus* Johnston occurred only once, as a single specimen, in one other day collection. The proportion of *A. caruanae* varied from 7 to 20 per cent.

When *A. caruanae* was found so abundantly in the College gardens, other places were investigated, the first being my garden at Beaumont. The collections obtained there both by day and at night were very similar to those from the College gardens and again *A. caruanae* was invariably present. The proportion varied from 7 to 27 per cent. Several places outside the City were then visited, in the hope that brief searches in suitable sites by the roadside might reveal the presence of *A. caruanae*. Specimens were found in this way at Dunkettle and at Blarney. The species has thus been found in places representing a large proportion of the Cork City region. The location of these places is shown in the sketch-map. At Dunkettle the roadway has been improved and the slugs were abundant under scattered stones among grass near the road. At Blarney they were found at two roadside places within half a mile of each other, in one case under the fallen bricks and stones of an old wall, in the other case under large stones at the edge of a wood near the village. The species found with *A. caruanae* at Dunkettle and Blarney were *A. hortensis*, *M. budapestensis* and *A. reticulatus*. Similar searches were made at five places farther away from the City but no *A. caruanae* were found, except that a single specimen at about one and a half miles east of Carrigaline was perhaps a young example of the species. As it died some time before it was possible to make a dissection the possibility that it was *Agriolimax laevis* (Müller) could not be excluded.

Blarney village is thus the farthest point from the City at which *A. caruanae* has as yet been identified, excluding the possible specimen from near Carrigaline. Even if the latter specimen is correct, however, it may be noted that it was found at the site of fairly extensive road-works. This raises the question of the habitats in which specimens have been found. The more or less marked association with human activities seems to correspond with what is at present known of the species in Britain.

In view of the numbers found in Cork, the lack of previous Irish records seemed at first a little surprising. This situation could possibly be due to recent introduction of the species, but as *A. caruanae* was not recognized in Britain until comparatively recently, it is perhaps more likely to have been present, but overlooked, in Ireland. This latter explanation is supported by the belief that in England *A. caruanae* is almost certainly native in the south-west. Its occurrence in the south of Ireland is therefore particularly interesting, especially if it is found elsewhere in this region. The localities mentioned in this account are in East and Mid-Cork, but the species has not yet been looked for in other divisions.

In conclusion, it is a pleasure to record my gratitude to Dr. H. E. Quick, who confirmed the original specimens of *A. caruanae*, for his generous advice and encouragement in many ways. I would like also to thank Mr. A. E. Ellis who, in his capacity as Recorder of the Conchological Society, confirmed the absence of previous records of *A. caruanae* from Ireland. This work was done in the Department of Zoology, University College, Cork.

SUMMARY

Agriolimax caruanae Pollonera is reported for the first time in Ireland, having been found abundantly at several places in and near Cork City.

ADDENDUM

At the meeting of the Conchological Society held on 18 April 1959, Dr. H. E. Quick exhibited *Agriolimax caruanae* collected by Mr. A. W. Stelfox in his garden in Tullybrannigan Road, Newcastle, Co. Down, Northern Ireland.

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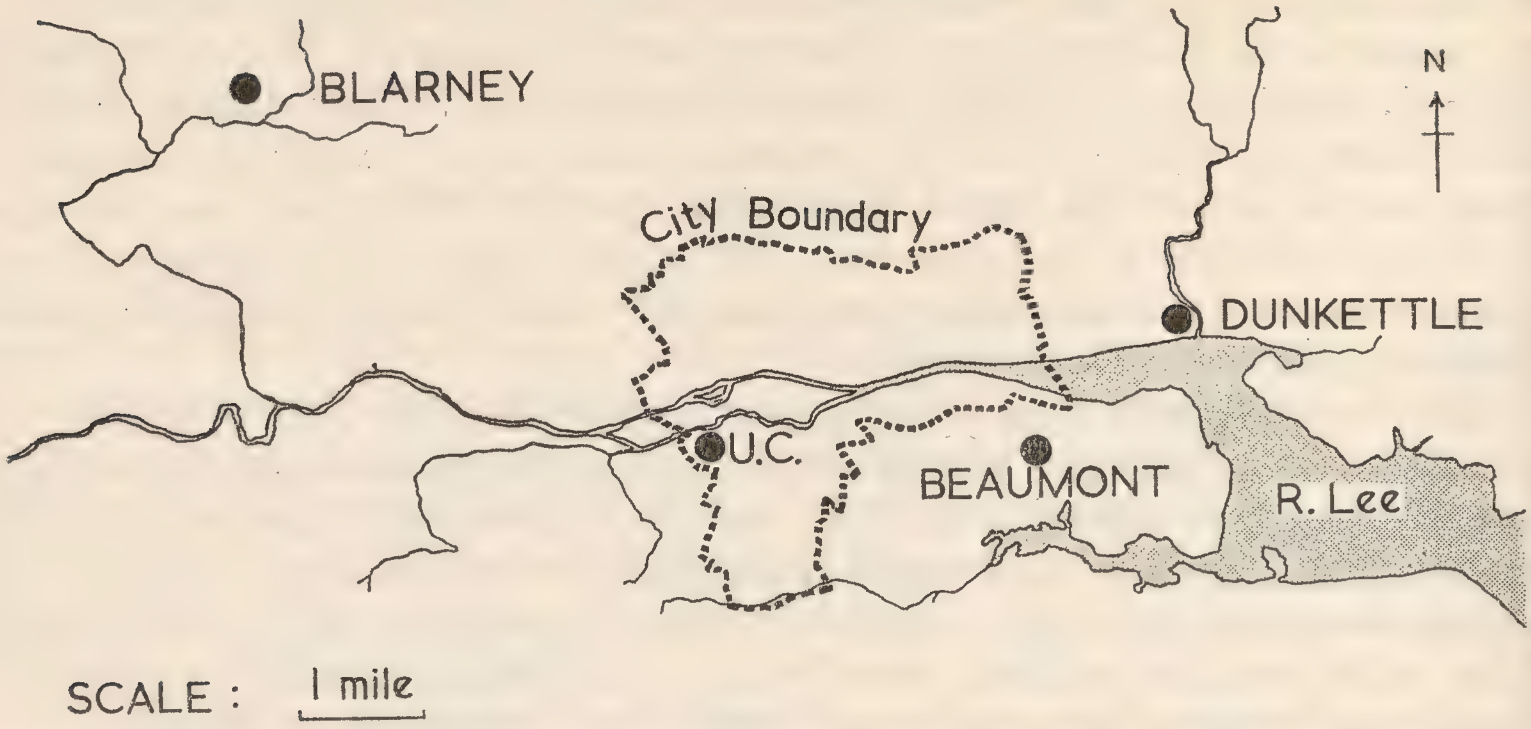

FIG. 1.—Sketch-map of the River Lee and boundary outline of Cork City, showing the location of places mentioned in the text. U.C.=The University College.

A GIANT *ACHATINA* FROM THE BELGIAN CONGO (*ACHATINA* (*ACHATINA*) *BALTEATA INFRAFUSCA* VON MARTENS)

By T. PAIN

(*Read before the Society*, 18 *April* 1959.)

IN this *Journal* (1953, **23,** 298) I recorded an unusually large example of the East African species, *Achatina* (*Lissachatina*) *reticulata* (Pfeiffer) nearly 215 mm. in height. A further very large shell, this time from the West African region, has recently been brought to my notice. This is a remarkably fine specimen of *A.* (*A.*) *balteata infrafusca* von Martens. It was collected by the late Dr. E. Dartevelle at Kassai near Kipala in the Belgian Congo in 1947. It measures : height 185, greatest width 88, aperture 85·5 × 51 mm. and consists of 9½ whorls. The previously largest recorded specimen of either race of *A. balteata* is a specimen of *infrafusca* s.s. from Lukolela, Belgian Congo, collected by Mr. J. P. Chapin (Bequaert, 1950, *Bull. Mus. Comp. Zool. Harvard*, **105,** No. 1, 46–47), this shell being 152 mm. in height. The specimen of *infrafusca* from Kassai is therefore, with the exception of certain examples of *A.* (*L.*) *reticulata* (Pfeiffer) and *A.* (*A.*) *achatina* (L.), amongst the largest of any land snail so far recorded. One can only conclude that conditions at Kassai are particularly suited to the development and growth of these large snails.

As pointed out by Bequaert (1950, 47) transitional specimens between the nominate race and *infrafusca* s.s. are known, and both were found living together in a colony at Leverville, Belgian Congo, by Mr. F. M. Dyke. Too little is however known regarding the distribution to decide as yet whether the subspecies should really be kept separate or merely considered a synonym. *A. balteata infrafusca* is at present recorded only from Cameroon and the French and Belgian Congos.

ORTHALICUS (METORTHALICUS) LABEO (BRODERIP): A RARE PERUVIAN LAND SNAIL

By T. Pain

(*Read before the Society*, 17 *January* 1959.)

This magnificent species, although described in 1828, had always remained extremely rare and could be considered perhaps the greatest prize the collector of exotic land shells might hope to obtain. It has recently, however, been collected in some quantity and specimens are now in a number of collections, both public and private. The story of its discovery, the subsequent disappearance of the type shell and then only known example, and the rediscovery of the species in the original locality 120 years later is as follows.

On Christmas Day 1827, Lt. Maw, R.N., in the course of his historic journey down the river Amazon from its source to the sea, stopped at a rancho (farm-house) at Toulea, about 9 leagues east of Chachapogas, Peru, situated at the highest limit of the mountain or forest district on the eastern side of the Andes, at about 8,000 feet above the sea. There he obtained one example of *O.* (*M.*) *labeo* and subsequently others were frequently seen by him in the forest between Chachapogas and Moyabamba. Two much larger living examples were handed to a native servant for safe keeping, but the man, not understanding his instructions, thought the snails were intended for food and cooked them, so destroying the shells. As a result of this unfortunate occurrence only one specimen eventually reached England, and was presented by Lt. Maw along with other material to the Zoological Society of London. This, then unique, specimen was described by Broderip (1828, 222) as a new species of *Bulimus*, *B. labeo*, "the blubber-lipped". This type, along with other rarities, subsequently disappeared from the Society's collection and was never recovered.

When Reeve (1848) wrote his monograph of the *Bulimus* no example of *O.* (*M.*) *labeo* was then available and he copied Broderip's description and figure, giving an account of the history of the species up to that time. Pilsbry (1899) also copied Broderip. Occasional examples did however reach Europe from time to time, as is proved by the presence of one from the S.I. da Costa collection, now in the British Museum (Natural History). Another was in the collection of the late Rev. E. G. Alderson. The original source and locality of this specimen is not known. That in the British Museum is stated to be from Chachapoyas, Arizona, Peru.

In 1947 when travelling in Peru, Colonel H. Burrington-Brown visited the Chachapogas–Moyabamba district and there obtained numerous examples of *O.* (*M.*) *labeo*, which he generously presented to the author. These snails were found crawling amongst the roots of trees, usually after rain, and the local native inhabitants were accustomed to use them as an article of food, wrapped in leaves and cooked in the shell in an open fire.

There is considerable variation in the colour of the periostracum, one fine example obtained by Colonel Brown being olive-green on the lower whorls and marked with interrupted dark green bands. Typical specimens are dark reddish-brown, becoming lighter on the spire. The extraordinarily thickened outer-lip is usually reddish-purple, and is remarkable not only for its great thickness, but for the unusual surface, which is rough and distinctly pitted.

Orthalicus (*Metorthalicus*) *labeo* (Broderip)

Bulimus labeo Broderip, 1828. *Proc. Zool. Soc. Lond.* **4**, 222, Sup. pl. 31.
Bulimus labeo Reeve, 1848. *Conch. Icon. Bulimus*, pl. 35, fig. 207. [not pl. 71, fig. 207b, nor pl. 72, fig. 207c, which represent *O.* (*M.*) *yatesi vicaria* (Fulton)].
Orthalicus (*Metorthalicus*) *labeo* Pilsbry, 1899. *Manual of Conch.* (2) **12**, 199, pl. 44, figs. 21, 22.
Orthalicus (*Metorthalicus*) *labeo* Strebel, 1909. Revision der Unterfamilie Orthalicinen, *Mittailugen aus dem Nat. Mus. Hamburg*, 169, pl. 33, fig. 462.

Original description—"Shell ovately produced, brown-chestnut, red towards the apex, variegated with brown, whorls 6 in number, ventricose, the last with two black bands, one round the middle, the other next the suture, penultimate whorl with two bands, both sutural, columella with a remarkable obtuse tooth, lip very thick reflected, pale chestnut above, black beneath, interior of the aperture whitish. Length 3″, max. width 1-6/8″."

Perhaps because of its unusual appearance, Reeve (1848) was led to conclude that Broderip's type of *labeo*, which it must be remembered was the only example he had ever seen, might be an abnormal form and figured (pl. 71, fig. 207b and pl. 72, fig. 207c) another shell which in his opinion represented the normal condition of it. This shell from the Cuming collection and now in the British Museum (Natural History), was obtained at Limabamba, Peru, at 8,000 ft. by O. T. Brown and was subsequently described by Fulton (*Ann. Mag. Nat. Hist.* (6) **18**, 1896, 103) as *Porphyrobaphe vicaria.* As shown by Strebel (1909, 167) this is in fact a form of the common Peruvian species *O.* (*M.*) *yatesi* (Pfeiffer) and is in no way related to Broderip's *labeo*, the remarkable development of the lip and curiously punctured peristome of which separate it from all other known *Orthalicus.*

O. (*M.*) *labeo* does not show much variation in size amongst adult examples, of which Broderip's type may be taken as average. The largest example obtained by Colonel Brown and now in the author's possession measures: height 87, greatest width 42, aperture (external) 51 × 26 mm. The greatly expanded and thickened outer-lip of this specimen measures 7·5 mm. across the rim.

The author's grateful thanks are due to Mr. T. E. Crowley and Mr. S. P. Dance, for their generous assistance in the preparation of these notes.

***Potamopyrgus jenkinsi* (Smith) in West Donegal.**—Considerable collecting was done in this area during 1905 and 1908 but *jenkinsi* was not found. On 10 June 1955, however, on the south shore of Kill Lough, near Dunfanaghy, the species occurred in myriads among *Scirpus lacustris*, *Sparganium*, *Littorella*, *Juncus bulbosus* and *Potamogeton* sp.

A. W. STELFOX.

OBITUARY

HUGH WATSON, 1885–1959

HUGH WATSON was born at Newcastle-on-Tyne on 1 June, 1885, being the third and youngest child of John Watson and Laura Elizabeth Watson (*née* Burnup), and died at his home at Cherry Hinton, near Cambridge, on 21 January 1959. He received private tuition under the Rev. A. J. Knapton and entered Trinity College, Cambridge, in October 1907, where his tutor was the Rev. R. St. J. Parry. He was placed in the first class of the Natural Sciences Tripos, part 1, in 1910, proceeding to the M.A. degree in 1914. Watson was of independent means and devoted his life to the study of malacology, besides being interested in a large number of very diverse charities and good works, about which he informed himself fully and to which he contributed with discrimination. Hugh Watson, then living at Lauder Grange, Corbridge-on-Tyne, was elected a member of the Conchological Society on 10 January 1900 and was President 1926–27. He was elected an honorary member in 1955. He was a life member of the Malacological Society of London, which he joined in 1905.

Watson was the last survivor of his family and left no near relatives. He was a reserved and apparently somewhat lonely man, and though he had a wide circle of correspondence amongst British and foreign malacologists, no one seems to have known him at all intimately; this was no doubt partly due to his generally poor health and frequent attacks of severe migraine. Nevertheless those who were privileged to meet him encountered a friendly welcome and a charming old-world courtesy. His knowledge of Gastropoda and the literature and taxonomy of the class was immense, and he would take any amount of time and trouble to instruct novices and to help all who consulted him. Watson's standard of scientific accuracy was very high; he would publish nothing until everything possible had been done to ensure the truth of every statement and to clarify all aspects of the subject, even at the cost of considerable delay. His papers are a model of style and lucidity, and very little of his output over many years has ever called for correction, though his insistence on meticulous accuracy has doubtless curtailed the amount of his published work. He was a skilled draughtsman, and his exquisite and accurate drawings of shells and anatomy are seen at their best when reproduced in collotype.

In his younger days Watson travelled and collected snails on the Continent, but for many years he remained at home and depended on other collectors to supply him with material for his studies, which were mainly concerned with the Gastropoda of Europe and South Africa.

Hugh Watson would listen with the utmost patience and even diffidence to the views of others, often far less well informed than himself, but had no hesitation in criticizing or condemning any superficial or inaccurate work, demanding from others the same exacting standard as he set himself. By his helpful and constructive advice he endeavoured to save authors from the humiliation of adverse criticism by ensuring the accuracy of their statements. There are many at home and abroad who will mourn the loss of a wise counsellor and remember Hugh Watson with gratitude and respect.

Grateful acknowledgments are tendered to Mr. F. Woods, Secretary of the Trustee Department, Norwich Union Life Insurance Society, and to Mr. B. W. Sparks for their kindness in supplying biographical particulars.

H. E. QUICK.

HUGH WATSON—An Appreciation

HUGH WATSON'S name has become something of a legend in the annals of twentieth century Conchology. The impact which he made upon this science and its devotees may be judged from his influential writings and from the controversy which they sometimes aroused. I would like to try to place on record the very different impact which he made upon an inexperienced young amateur who was privileged to know him personally.

I first visited Mr. Watson in November 1957, since when I may have seen him about four times. This may seem a brief acquaintance upon which to found an appreciation of such a man, but one of his remarkable gifts was the ability to crowd many impressions into one afternoon, with a minimum of wasted time. He used to say that he grew tired very quickly and could therefore talk for no longer than an hour, but one could seldom observe this time limit because his visitors were so few and he was so reluctant to see them leave. As far as I was concerned, this could not have been because he expected much information, though he was very patient with inexperience and would take great trouble to explain the complex details of his current taxonomic problems. Here, as always, he had a great ability to bring out the interest of a subject which many regard with boredom or even antipathy. He would present his arguments with a most attractive clarity and precision of thought and speech, and his replies to my questions were always phrased with a curious Edwardian courtesy exactly matching the interior of his old-fashioned study.

For many years he had been confined to his house, where a housekeeper and gardener looked after him. His health made it difficult for him to do much collecting, either on his own account or for his colleagues abroad. Collecting on his behalf was therefore a particularly great pleasure, though he was hardly the person one would normally have chosen as an instructor in the art of preparing specimens and packing them for the post. His letters of acknowledgment, written in close, angular handwriting on the familiar cream postcards, were another aspect of the pleasure of his friendship.

Mr. Watson was in the habit of supplying his friends with lists of species not hitherto found in Cambridgeshire or in Britain, but which, he felt, had probably been overlooked. When I happened to mention that I had found it necessary to dissect some specimens in order to satisfy myself that they were not among his desiderata, he was delighted at the prospect of a new recruit to Malacology. He considered that Malacology was a much neglected science, and it must have been a great disappointment to him to have to give up lecturing on this subject at such an early age.

Most of us will only be able to regret his passing as that of an authority in his particular study. A few, more fortunate, can look back in gratitude to the memory of a great friend.

HUGH INGRAM.

REVIEW

Sea Shells of Tropical West America. Marine Mollusks from Lower California to Colombia. A. MYRA KEEN. Pp. xii, 624 (3 pages Supplementary Errata), frontispiece, 10 colour plates, about 1,500 illustrations. Map inside both covers. 8°. Stanford University Press, 1958. £5. (London: Oxford University Press.)

THIS attractive work is the first attempt to list and illustrate the marine shells of the entire Panamic province from Lower California to Colombia. About 1,650 species are listed and most of them are illustrated. The colour plates show ten of the larger more colourful species. Concise descriptions accompany the illustrations, together with remarks on their range and frequency. Keys are given for a number of the more critical genera. The Appendices include a short glossary of technical terms used in scientific nomenclature or to describe shells, a key to the major pelecypod and gastropod divisions and a remarkably complete bibliography. The Addenda section is a commentary on a number of type specimens in the British Museum (Natural History). A Supplementary Errata of three pages has been issued separately.

The Panamic province is so rich in species and genera that such a book has long been a desideratum. Undoubtedly the most outstanding feature is the wealth of illustration. For the most part this comprises photographs or drawings of actual specimens, in the absence of which the author has given faithful reproductions of original figures, a boon to those workers without access to the early literature. A uniform light grey background sets off most of the figures to advantage, although the outlines are a little indistinct in some. Additional figures of certain shell features, e.g. chiton valves and periostracal hairs, though accurate, may confuse the student at first, as it is necessary to turn to an Appendix for an explanation of them. The smaller species are not dealt with in detail, but a representative of each genus is illustrated and bibliographic references to the pertinent literature are given. In nearly every instance the description and illustration of a species occur on opposite pages, a most helpful arrangement and one that must have decided the lay-out of the book. Each description includes such additional information on the species as is not evident in the illustration, dimensions, range, frequency and sometimes a short nomenclatural discussion. It is refreshing to see such careful attention to correct scientific nomenclature in a popular handbook, a subject of bewilderment and annoyance to most amateurs. Dr. Keen points out that it would be necessary to invent " popular names " for most of the Panamic species and the futility of giving English equivalents for the latin binomials is well demonstrated.

Altogether this is a valuable piece of work, well written, copiously illustrated and intelligently arranged, qualities that ensure maximum utility for minimum effort—the hallmark of all good handbooks. Over a hundred years ago Forbes and Hanley produced their monumental *History of the British Mollusca* in four volumes, each one the size of that under review. By comparison, Dr. Keen's work, on a fauna incomparably richer, is evidently a masterpiece of compact writing.

S. P. DANCE.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND

767th Meeting, held at the British Museum (Natural History), 13 December 1958

Mr. A. E. Ellis, vice-president, in the chair.

Member Elected

William Groundwater, M.A.

Communications

" *Planorbis vortex* (L.) with double aperture," by T. E. Crowley.

" *Hygromia limbata* (Drap.) and *H. cinctella* (Drap.) in South Devon," by G. W. Pitchford.

Exhibits

Special exhibits: Phasianellidae and *Plekocheilus*. Specimens of the former were exhibited by Mr. R. W. Greenish, Mr. R. P. Scase, and from the British Museum collections by Mr. C. P. Castell and Mr. S. P. Dance. Mr. T. E. Crowley and Mr. T. Pain showed species of *Plekocheilus* from South America and the West Indies.

768th Meeting, held at the British Museum (Natural History), 17 January 1959

The President, the Rev. H. E. J. Biggs, in the chair.

Member Elected

Professor Masao Azuma.

Communications

" *Orthalicus* (*Metorthalicus*) *labeo* (Broderip)," by T. Pain.

" Inheritance of mantle colour in *Hygromia striolata* (C. Pfeiffer)," by A. J. Cain.

" Opercula of calcite in the Bithyniinae," by Dennis Curry.

" The eggs of *Vitrina pellucida* (Müller)," by G. W. Pitchford.

Exhibits

Special exhibits: *Ianthina*, *Thiara*. Mr. C. P. Castell exhibited fossil and Mr. S. P. Dance recent Thiaridae from the British Museum collections, and Mr. F. H. Cozens *Ianthina* from the Wilkins collection. Mr. D. Curry and Mr. T. Pain showed specimens to illustrate their communications.

Mr. S. P. Dance: *Sea Shells of Tropical West America*, by A. Myra Keen (1958); *Cypraea hirasei* from Japan.

Mr. T. E. Crowley and Mr. T. Pain: Thiaridae and *Achatina schweiforthi* to show its variations.

Mr. R. P. Scase: *Cypraea melwardi* and *Voluta grossi* from Queensland.

Mr. F. R. Woodward: *Turcicula bairdii*, California, and *Ledella junonii*, Florida.

769th (Annual) Meeting, held at the British Museum (Natural History), 21 February 1959

The President, the Rev. H. E. J. Biggs, in the chair.

Member Deceased

The President reported the death of Hugh Watson, M.A., a former president of the Society.

Election of Scrutineers

Mrs. M. Ainsley and Mr. G. W. Pitchford were elected Scrutineers.

Election of Auditors

Miss M. Maitland Howard and Mr. S. P. Dance were elected Auditors.

Annual Reports

The reports of the Council, the Curator and the Recorders were presented and adopted. The Treasurer's report and statement of accounts were postponed until 14 March, as the auditors had been unable to clear up a few points in the accounts in time for the Annual Meeting.

Votes of Thanks

Votes of thanks were approved to the Trustees of the British Museum (Natural History) for permitting the Society to hold meetings at the Museum, to the Keeper of Zoology and to Mr. I. C. J. Galbraith for allowing members to use the Molluscan library and collections, to Mr. S. P. Dance for his voluntary attendance at the Museum on meeting days for the convenience of members wishing to consult the library and collections, and to the Officers and Council for their work on behalf of the Society.

Presidential Address

The President delivered his address on " A contribution to the study of the genus *Eremina*," illustrated by maps and exhibits.

Election of Officers and Council

The Officers and Council were declared elected as shown on page 331.

Exhibits

Mr. J. F. M. de Bartolomé: species of *Campylaea* from Jugoslavia and France, including *C. desmoulinsi* var. *crombezi* (Bourguignat), recorded in 1880 from the Col de Fenestre, Alpes-Maritimes, which according to Germain (1930) had not been found since then. Mr. de Bartolomé collected the variety in the type locality, 8 October 1958.

Mr. T. E. Crowley and Mr. T. Pain: subspecies of *Burtoa nilotica* and a map illustrating their distribution.

Mr. S. P. Dance: *Pleurotomaria africana* (see *J. Conch.* **23**, p. 2, pl. 1), the seventh known specimen, dredged off Durban in 160–180 fathoms, recently acquired by the British Museum.

Mrs. N. F. McMillan: many sets of Helicidae, mainly from Scotland. These included Holocene Helices from North Ronaldsay, amongst them shells identified as *H. nemoralis* by Kennard (*Proc. Geol. Assoc.* **28**, 169); recent *H. hortensis* from North Ronaldsay and Hoy; *H. nemoralis* (dead shell) from Gourdon, Kincardineshire, ten miles north of the most northerly station known for this species on the east coast; *Hygromia hispida* collected by Mr. A. W. Stelfox at Stromness, 1908, and at Bergen, Norway, and by Mrs. McMillan at Braebister, Hoy, 1957; and varieties of *H. striolata*, which is rare in Cheshire, from Storeton Woods, Wirral.

Mr. J. F. Peake: varieties of *Helix nemoralis* from Sligo, including the large "Annacoona form" (see *J. Conch.* **22**, p. 80).

Dr. H. E. Quick: *Hygromia cinctella*, *limbata*, *subvirescens* and *subrufescens* from South Devon.

Mr. A. E. Salisbury: varieties of *Helix aspersa* and an example of the rare monst. *cornucopiae*; *Helicigona lapicida* var. *albina* from Lynton, North Devon.

Mr. R. P. Scase: examples of shells of marine Mollusca attached to one another or to other organisms.

Report of the Council

Eighteen members were elected during the year, but the losses have been heavy, mainly as a result of a revision by the Treasurer and the Secretary of the list of members, which it is hoped now approximates more closely to a paid-up membership list. The names of 18 members have been removed for non-payment of subscriptions and 5 members are still in arrears for 1958. There have been 8 resignations and the Society has lost 5 members by death, namely E. W. Swanton and H. Watson, both vice-presidents, also S. G. King, P. P. Milman and T. O. Tippet. This results in a net loss of 13, leaving a total membership of 183, including 6 honorary members.

Seven ordinary meetings and an annual general meeting have been held at the British Museum (Natural History). On 28 June 1958 Dr. C. A. Wright gave a demonstration in his laboratory at the Museum to members of the Society of his experimental research on freshwater gastropods implicated in the transmission of trematode parasites.

Two numbers of *The Journal of Conchology* were published, namely volume 24, No. 7, 6 February, and No. 8, 29 August 1958.

Curator's Report

On taking over supervision of the Society's voucher collection last year, I found the non-marine section arranged geographically according to vice-counties with no regard to taxonomic grouping. This arrangement did not appear to be very helpful if one wanted to ascertain the distribution of any particular species, so it was decided to arrange the collection according to the systematic classification, and at the same time to mark all the species represented in the collection on printed vice-county lists. So far the lists have been marked and the shells sorted under species, but the final arrangement and labelling has still to be completed.

Droplets of water have been found in about half the specimen tubes. According to information received from a well-known firm manufacturing glass equipment, it is natural for specimens of a limestone or similar composition to attract moisture from the air. I am advised that, after the tubes and specimens have been dried, accumulation of moisture can be prevented by placing in the drawers a small tin of a certain drying agent. None of the specimens seem so far to have suffered any deterioration.

During the year twenty sets of voucher specimens have been added to the collection, and it is hoped that all those contributing new records will present voucher specimens. Many vice-counties are poorly represented and the larger cabinet into which the collection is being transferred will amply accommodate future donations. It is hoped to prepare a list of those vice-counties which are particularly ill represented in the voucher collection.

F. H. COZENS.

Recorder's Report : non-marine Mollusca

Since the publication of the last report (vol. 24, p. 295), the following records, nearly all from Scotland, have been authenticated.

Cornwall East (2) : *Acicula fusca*, *Vertigo substriata*, Looe, H. Ingram.

Oxford (23) : *Agriolimax caruanae*, Blenheim Palace, Miss G. Beeson.

Leicester (55) : *Arion rufus*, Loughborough, I. C. J. Galbraith.

Kirkcudbright (73) : *Potamopyrgus jenkinsi*, Tarff, 1946, D. K. Kevan.

Lanark (77) : *Carychium tridentatum*, Elvanfoot ; *Planorbarius corneus*, Culter ; *Pisidium lilljeborgii*, White Loch, Carnwith, D. K. Kevan.

Peebles (78). *Carychium minimum*, Mount Bog near Blyth Bridge ; *C. tridentatum*, between Peebles and Cardroma, D. K. Kevan.

Selkirk (79) : *Potamopyrgus jenkinsi*, Bowhill ; *Lymnaea stagnalis*, Whitmuir Loch, A. J. Smith.

Haddington (82) : *Planorbarius corneus*, Aberlady Bay, A. J. Smith (also D. K. Kevan).

Edinburgh (83) : *Carychium minimum*, Crichton, D. K. Kevan.

Fife (85) : *Planorbis carinatus*, Loch Leven, Kinross, D. K. Kevan.

Kincardine (91) : *Planorbis albus*, *P. contortus*, Clattering Bridge, A. D. Berrie.

Aberdeen North (93) : *Planorbis albus*, *Segmentina complanata*, Loch of Strathbeg, Mrs. N. F. McMillan.

Banff (94): *Potamopyrgus jenkinsi*, Sandend, R. Richter; Cullybhan Bay, Mrs. N. F. McMillan.

Elgin (95): *Potamopyrgus jenkinsi*, Speybay, R. Richter.

Easterness (96): *Potamopyrgus jenkinsi*, Loch Flemington, Nairn, R. Richter.

Westerness (97): *Potamopyrgus jenkinsi*, Arisaig, T. Warwick.

Sutherland West (108): *Potamopyrgus jenkinsi*, Loch Lanlish, Durness, 1956, T. Warwick.

Orkney (111): *Hygromia hispida*, Hoy, Mrs. N. F. McMillan.

Down (115): *Agriolimax caruanae*, Newcastle, A. W. Stelfox.

Cork East (146 E): *Agriolimax caruanae*, Dunkettle, P. Makings.

Cork Mid (146 M): *Agriolimax caruanae*, University College, Cork, P. Makings.

A. E. E.

770th (Extraordinary General) Meeting, held at the British Museum (Natural History), 14 March 1959

The President, the Rev. H. E. J. Biggs, in the chair.

Statement of Accounts

The Hon. Treasurer presented the audited accounts for 1958, which were adopted.

771st Meeting, held at the British Museum (Natural History), 14 March 1959

The President in the chair.

Members Elected

David John Hume.

Mrs. Elsie Maud Sheppard.

Communications

" *Agriolimax caruanae* Pollonera new to Ireland," by Dr. P. Makings.

" Some land Mollusca from northern Iraq," by the Rev. H. E. J. Biggs.

Exhibits

Special exhibits: *Aporrhais* and *Xesta*. Fossil Aporrhaidae were exhibited by Mr. C. P. Castell and a series of *Xesta citrina* by Mr. S. P. Dance, from the British Museum collections. The President exhibited specimens to illustrate his paper.

772nd Meeting, held at the British Museum (Natural History), 18 April 1959

Dr. H. E. Quick, vice-president, in the chair.

Communications

" A giant *Achatina* from the Belgian Congo," by T. Pain.

Exhibits

Special exhibits: British conchological books and personalia.

Mr. C. P. Castell: some of J. W. Taylor's notebooks used in the preparation of his *Monograph of the land and freshwater Mollusca of the British Isles*; one of A. S. Kennard's county notebooks; G. Brander's *Fossilia Hantoniensis*, 1776; J. Sowerby's *Mineral Conchology*, 1812; F. E. Edwards, *Monograph of British Eocene Mollusca*, 1849 (from the British Museum library).

Mr. S. P. Dance: a portrait of J. G. Jeffreys; the author's interleaved and annotated copy of L. E. Adams, *Collector's Manual of British land and freshwater shells*, 2nd edition, 1896; T. Pennant's *British Zoology*, vol. 4, 1774.

Mr. M. P. Kerney: J. Morton's *Natural History of Northamptonshire*, 1712 (containing one of the earliest county lists of Mollusca).

Mr. T. Pain: E. G. Alderson's own copy of *Studies in Ampullaria*, 1925, hand-coloured by the author, together with some of the figured shells.

Dr. H. E. Quick: *Agriolimax caruanae* collected by Mr. A. W. Stefox in his garden at Newcastle, Co. Down; *Phytia myosotis* from Oxinch, Glamorgan.

Mr. R. P. Scase: some of E. W. Swanton's papers and correspondence on British Mollusca.

773rd Meeting, held at the British Museum (Natural History), 9 May 1959

The President, the Rev. H. E. J. Biggs, in the chair.

Members Elected

Dennis Harper Kennelly.
Stanley Skillen, M.Sc., M.Inst.Biol.

Communication

"*Gyrina gigantea* (Lamarck), an unexpected addition to the South African marine fauna," by S. P. Dance.

Exhibits

Special exhibits: *Ostrea*, *Pila* (*Ampullaria*). Examples of these and related genera were shown by the President, Mr. C. P. Castell and Mr. S. P. Dance (from the British Museum collections), Mr. T. E. Crowley, Mr. T. Pain and Mr. R. P. Scase.

Mr. S. P. Dance: facsimile copy of Roeding's *Museum Boltenianum*, 1798, in which the name *Pila* was first proposed; Reeve's *Monograph of Ampullaria* (*Conch. Icon.*), 1856; also specimens to illustrate his paper.

Miss L. F. Hanna: *An illustrated Index of Tasmanian Shells*, by W. L. May, revised by J. H. Macpherson, 1958.

Dr. H. E. Quick: *Milax budapestensis* from a beechwood north of Arundel, Sussex.

LIST OF MEMBERS

(*August*, 1959)

(L = Life Member, H = Honorary Member, P = has filled the office of President.)

Date of Election.		
1917		Adams, Rev. Canon J. H., Landulph Rectory, Saltash, Cornwall.
1951		Ainsley, Mrs. M., High Gables, Primrose Ridge, Godalming, Surrey.
1956		(Amsterdam) Zoologisch Museum, Plantage Middenlaan 53, Amsterdam C, Netherlands.
1955		Anderson, M. M., B.Sc., F.G.S.,, F.L.S., Geology Department, University College, Mandalay, Burma.
1952		Appleyard, S. G., 29 Berkeley Mount, Leeds 8, Yorkshire.
1914		Arkell, A. J., O.B.E., M.A., B.Litt., Hillside, Ballinger, Great Missenden, Bucks.
1956		Atkins, L. S., B.A., B.Sc., Andreas, Rosebank Park, Douglas Road, Cork, Ireland.
1955		Australian Museum, College Street, Sydney, N.S.W., Australia.
1959		Azuma, Prof. Masao, 80 Araebisu-chō, Nishinomiya, Hyogo-Pref., Japan.
1957		Badcock, E. C., Elbury, Bassetsbury Lane, High Wycombe, Bucks.
1952	L	Baily, Joshua L., Jr., A.B., A.M., Mus.B., Sc.D., 4435 Ampudia Street, San Diego 3, California, U.S.A.
1951		(Bangor) The Science Library, University College of North Wales, Bangor, Caernarvonshire.
1946		Barker, R. Wright, M.A., F.G.S., F.G.S.A., Shell Development Co., E. and P. Research Division, 3737 Bellaire Boulevard, Houston, Texas, U.S.A.
1920		Barnacle, G. A. S., B.A., 3 Osborn Lodge, 8 West Parade, Worthing, Sussex.
1911	L	Barnard, K. H., D.Sc., F.L.S., South African Museum, Cape Town, South Africa.
1949		Bartolomé, J. F. M. de, 12 Thornsett Rd., Sheffield 7.
1907	L	Bartsch, P., D.Ph., Smithsonian Institute, Washington, D.C., U.S.A.
1901	L	Beeston, H., Sunnymead, South Street, Havant, Hants.
1919		Belcher, T. E., 53 Whitfield, Morden, Wareham, Dorset.
1937		Belfast Museum, Students' Library, Belfast, Northern Ireland.
1946	L	Berry, S. S., A.M., Ph.D., 1145 West Highland Avenue, Redlands, California, U.S.A.
1919 1930	P	Biggs, Rev. H. E. J., F.L.S., 19 Siward Road, Bromley, Kent.
1951		Bishop, E. O., 5 Hanbury Park Road, St. John's, Worcester.
1924		Blok, A., O.B.E., B.Sc., A.M.I.E.E., Downs Cot, Falmer Road, Rottingdean, Sussex.
1907	H P	Bloomer, H. H., F.L.S., Longdown, Sunnydale Road, Swanage, Dorset.
1930 1950		Boettger, Prof. Dr. C. R., Zoologisches Institut, Pockelsstrasse 10a, Braunschweig, Niedersachsen, Germany.
1952		Bolling, W., Luitpold-Apotheke, Luitpoldstrasse 33, Bamberg, Bavaria, Germany.
1952		Boswell, Mrs. H., P.O. Box 8081, Johannesburg, South Africa.
1958		Bowden, J., M.B., B.S., B.Sc., Ph.D., Department of Anatomy, Queen's University, Belfast, Northern Ireland.
1948		Brown, D. E., A.L.A., The Croft, Caunton, Newark, Notts.
1953		Brown, V. A. G., 15 Woodland Way, Highcliffe, Christchurch, Hants.
1955		Burch, J. Q., 1584 West Vernon Avenue, Los Angeles 62, California, U.S.A.
1956		Burchell, Major J. P. T., M.C., F.L.S., F.S.A., Falcon Cottage, Fawke Common, Sevenoaks, Kent.
1927		Burton, E. St. J., F.G.S., F.R.S.A., F.L.S., St. Annes, Seaward Avenue, Barton-on-Sea, Hants.

1951 Cain, A. J., M.A., D.Phil., Department of Zoology and Comparative Anatomy, University Museum, Oxford.
1954 Carmichael, D. S. 137 Hamilton Terrace, London, N.W. 8.
1945 Castell, C. P., B.Sc., F.G.S., Department of Palaeontology, British Museum (Natural History), London, S.W. 7.
1952 Chancellor, R. J., 58 Lonsdale Road, Oxford.
1926 Clench, William J., B.S., M.S., Museum of Comparative Zoology, Harvard University, Cambridge 38, Massachusetts, U.S.A.
1952 Colville, B., 575 Meanwood Road, Leeds 6.
1938 Comfort, A., Ph.D., 44 The Avenue, Loughton, Essex.
1957 Cooke, Major J. C., F.Z.S., Simonsbath Lodge, Simonsbath, Minehead, Somerset.
1948 (Copenhagen) Universitetets Zoologiske Museum, Krystalgade, Copenhagen K, Denmark.
1956 Cousins, R. J., Little Courts, Banwell, Weston-super-Mare, Somerset.
1951 Coxhead, P., 12 Cambridge Square, London, W. 2.
1957 Cozens, F. H., 57 Greencourt Rd., Petts Wood, Kent.
1910 Cribb, Rev. Canon C. T., B.A., The Vicarage, Moseley, Birmingham.
1957 Crowley, Miss J. C., B.Sc., A.I.M.L.T., Red Cottage, Ompton, Newark, Notts.
1951 Crowley, T. E., B.Sc., A.M.I.C.E., Clonard Cottage, Rowlands Avenue, Hatch End, Middlesex.
1955 Curry, D., M.A., F.G.S., Eastbury Grange, Watford Road, Northwood, Middlesex.
1950 Dance, S. P., Department of Zoology, British Museum (Natural History), London, S.W. 7.
1946 d'Attilio, A., 44 Lynwood Drive, Valley Stream, Long Island, New York, N.Y., U.S.A.
1948 Davies, Miss S. M., 63 Beechwood Road, Sanderstead, Surrey.
1951 Davis, Mrs. M. M., The Pantiles, Old Avenue, West Byfleet, Surrey.
1946 Dawson, W. R., F.R.S.E., F.S.A., Simpson House, Simpson, Bletchley, Bucks.
1956 Dearing, E., B.Sc., 37 Ormerod Road, Burnley, Lancs.
1909 L P Diver, Capt. C. R. P., C.B., C.B.E., M.A., F.L.S., F.R.G.S., Squirrels, Kennel Lane, Frensham, Surrey.
1957 Drake, R. J., B.A., Department of Zoology, University of Arizona, Tucson, Arizona, U.S.A.
1958 Duckworth, J. R., 43 Lowergate, Clitheroe, Lancs.
1910 Dyke, F. M., B.Sc., Woodside, Worth, Sandwich, Kent.
1930 L Elliott, Mrs. E. C., Marden Road, Payneham, South Australia.
1923 P Ellis, A. E., M.A., F.L.S., Epsom College, Epsom, Surrey.
1924 Feen, Mevr. W. S. S. van der, Zoölogisch Museum, Plantage Middenlaan 53, Amsterdam C, Netherlands.
1946 Feliksiak, S., M.A., Ph.D., Polish Museum of Zoology, Warsaw, Poland.
1958 Fletcher, E. W., 37 Holland Road, London, W. 14.
1930 Forcart, L., Ph.D., Naturhistorisches Museum, Augustinergasse 2, Basel, Switzerland.
1907 L Gabriel, C. J., 297 Victoria Street, Abbotsford, Victoria, Australia.
1956 Galbraith, I. C. J., M.A., Department of Zoology, British Museum (Natural History), London, S.W. 7.
1957 Geological Survey and Museum, H.M., Exhibition Road, London, S.W. 7.
1950 Glennie, Brig. E. A., Seaton House, Shrublands Road, Berkhamsted, Herts.
1957 Goodchild, M., 2 Russell Street, Chichester, Sussex.
1958 Grantier, Mrs. B. J., c/o Arabian American Oil Co., Box 1545, Dhahran, Saudi Arabia.
1957 Greenish, R. W., White Ridge, Ruxley Heights, Claygate, Surrey.
1921 Grensted, Rev. Canon L. W., D.D., 9 Shepherds Way, Cirencester, Glos.

1951 Griffiths, Lt. Col. R. J., B.Sc., U.K.M.O.S.S., 339 Swanston Street, Melbourne, C. 1., Victoria, Australia.
1958 Groundwater, W., M.A., The Schoolhouse, Stromness, Orkney.
1947 Guiler, E., B.Sc., Zoology Department, The University, Hobart, Tasmania.
1909 1939 Haas, Dr. F., Chicago Natural History Museum, Chicago 5, Illinois, U.S.A.
1957 Hanna, Miss L. F., c/o Barclays Bank, Ltd., 108 Queen's Gate, London, S.W. 7.
1952 Harper, F. J., B.Sc., Department of Agriculture, Kuching, Sarawak.
1958 Havas, Dr. F. de, Holmsbury House, Holmbury St. Mary, Dorking, Surrey.
1907 Hawkins, Prof. H. L., D.Sc., F.R.S., 63 Tilehurst Road, Reading, Berkshire.
1953 Hemming, C. F., B.A., Desert Locust Survey, P.O. Box 231, Asmara, Eritrea, Ethiopia.
1919 L P Hopwood, A. T., D.Sc., F.L.S., 99 Clifton Hill, London, N.W. 8.
1950 Howard, Miss M. M., Flat 3, Ashwood House, 69 Grange Road, Sutton, Surrey.
1909 Huggins, H. C., 65 Eastwood Boulevard, Westcliff-on-Sea, Essex.
1959 Hume, D. J., Cliff Park, Teignmouth, Devon.
1951 Hunter, W. R., B.Sc., F.G.S., Department of Zoology, The University, Glasgow, W. 2.
1948 Iliffe, Lady Charlotte, Yattendon Court, Newbury, Berkshire.
1957 Ingram, H. A. P., 64 Clifton Road, Rugby, Warwickshire.
1958 Istituto Italiano Idrobiologia, Verbania Pallanza, Italy.
1901 H P Jackson, J. W., D.Sc., F.G.S., F.S.A., 6 Brown Edge Road, Buxton, Derbyshire.
1952 Jacobs, G., 853 Riverside Drive, New York 32, N.Y., U.S.A.
1937 L Janson, R. B., F.R.E.S., 44 Great Russell Street, London, W.C. 1.
1954 Johnson, R. I., 124 Chestnut Hill Road, Chestnut Hill, Massachusetts, U.S.A.
1948 Jones, H. F., 67 Tantallon Road, London, S.W. 12.
1958 Jones, Mrs. J. Llewellyn, M.A., M.B., B.Ch., Honan, West Mersea, Essex.
1957 Jope, Mrs. H. M., Queen's University, Belfast, Northern Ireland.
1952 Kay, C. B., B.Sc., R.A.F., Batham Gate, Bradwell, Sheffield.
1959 Kennelly, D. H., 5 Fourie Street, Uitenhage, South Africa.
1953 Kerney, M. P., B.Sc., Vasconia, Crown Dale, London, S.E. 19.
1930 Kevan, D. K., F.C.R.A., F.R.S.E., 9 Cluny Drive, Edinburgh 10.
1948 Kisch, B. S., C.I.E., 38 Boulevard Thiers, St. Jean-de-Luz, B.P., France.
1948 Koch, H. J., P.O. Box 1122, Johannesburg, Transvaal, South Africa.
1900 H Laidlaw, Dr. F. F., Foxearth Rectory, Sudbury, Suffolk.
1925 L Lang, W. D., M.A., Sc.D., F.R.S., Lias Lea, Charmouth, Bridport, Dorset.
1917 Langmead, Dr. L. B., 15 The Royal Chase, Tunbridge Wells, Kent.
1957 Laufeld, S., N. Stenbocksgat 44, Hälsingborg, Sweden.
1958 Leicester City Museum and Art Gallery, New Walk, Leicester.
1949 Liliefelt, K. G., Gustaf Rydbergsgatan 2, Malmö, Sweden.
1956 Lloyd-Evans, L., M.B., Ch.B., The Old House, Ware, Herts.
1954 Lopes, H. de Souza, Instituto Oswalso Cruz, Caixa Postal 926, Rio de Janeiro, Brazil.
1933 Lowe, R. H., B.A., 4 Claremont Road, Roker, Sunderland, Co. Durham.
1956 Ložek, Dr. V., Quaternary Department, Institute of Geology, Malá Strana, Malostranskí nám 18, Prague 1, Czechoslovakia.
1919 Lumb, J. H., 1a Clarendon Place, Hopwood Lane, Halifax, Yorkshire.
1958 McCallum, Miss H. M. A., 268 Boldmere Road, Sutton Coldfield, Warwickshire.
1930 Macdonald, R., B.Sc., 21 Heathfield Road, Cliftonville, Belfast, Northern Ireland.
1915 McGregor Memorial Museum, Kimberley 1, South Africa.

1930 L P McMillan, Mrs. N. F., The Nook, Uplands Road, Bromborough. Cheshire.
1958 Machin, J., 55 Gubyon Avenue, Herne Hill, London, S.E. 24.
1957 Malatesta, A., Dr.Sc., Geologo Capo, Servizio Geolico d'Italia, Largo S. Susanna 13, Rome, Italy.
1946 Mandahl-Barth, G., M.Sc., D.Phil., Danmarks Akvarium, Charlottenlund, Denmark.
1954 Marine Biological Association, The Laboratory, Citadel Hill, Plymouth, Devon.
1956 Mehta, Mrs. A. F., B.A., P.O. Box 336, Zanzibar, British East Africa.
1948 Millott, J. O'N., Ph.D., B.Sc., 23 Sandy Lane, Boughton, Cheshire.
1927 Morehouse, Mrs. E. M., 23 Queen's Road, Doncaster, Yorkshire.
1950 Nature Conservancy, The, 19 Belgrave Square, London, S.W. 1.
1954 Nederlandse Malacologische Vereniging, c/o Zoölogisch Museum, Plantage Middenlaan 53, Amsterdam C, Netherlands.
1947 L Nicholson, N. W., Millguard, Tiverton, Devon.
1946 Pain, T., 16 Landseer Buildings, Millbank, London, S.W. 1.
1951 Pakistan Zoological Survey Department, 183 McLeod Road, Ispahani Building, Karachi 1, Pakistan.
1957 Palmer, Miss D. L., 14 St. James Road, Harpenden, Herts.
1919 L Paton, Mrs. B. J., Tywyn, Weybourne, Norfolk.
1958 Peake, J. F., B.Sc., 17 Tillett Road, Norwich, Norfolk.
1913 L Pellow, N. E., 193 Lichfield Road, Four Oaks, Birmingham.
1949 Pitchford, G. W., 18 Vicarage Road, Southwell, Notts.
1947 Port Elizabeth Museum and Snake Park, 28 Bird Street, Port Elizabeth, South Africa.
1923 L Prashad, B., D.Sc., F.L.S., 10 Dobhalwala Road, Dehra Dun, U.P., India.
1957 Prebble, L. C., Albert Cottage, Binstead Hill, Binstead, Ryde, Isle of Wight.
1916 H P Quick, H. E., M.B., B.S., B.Sc., F.R.C.S., Craythorne, Shinfield Road, Reading, Berkshire.
1951 Raffray, C. A., 20 Devonshire Road, Salisbury, Wilts.
1949 Rees, W. J., D.Sc., British Museum (Natural History), London, S.W. 7.
1929 Rendall, R., Dawnvale, Willow Road, Kirkwall, Orkney.
1946 Richardson, D. N., Flat 3, Rusholme Court, Crockham Hill, Edenbridge, Kent.
1954 Robinson, E., 8 Sun Wood Avenue, Shelf, Halifax, Yorkshire.
1957 Robson, E., M.P.S., Ph.C., P.O. Box 30077, Nairobi, Kenya.
1957 Rombouts, A., 25 van der Merwe Street, Rietondale, Pretoria, South Africa.
1906 H P Salisbury, A. E., A.M.I.E.E., 51 Amersham Hill, High Wycombe, Bucks.
1938 San Diego Society of Natural History, Balbao Park, San Diego, California, U.S.A.
1958 Sarony-Frye, L., 11 Cranford Way, Twickenham, Middlesex.
1957 Scase, R. P., Royal Horticultural Society's Gardens, Wisley, Ripley, Woking, Surrey.
1918 L Schlesch, H. A., D.Sc., L.A.S., Skansen, Sortsø Strand, Stubbekøbing, Falster, Denmark.
1959 Sheppard, Mrs. E. M., 48 Chaldon Common Road, Chaldon, Surrey.
1957 Shuttleworth, A. E., 1 Harbledown Road, London, S.W. 6.
1959 Skillen, S., M.Sc., M.Inst.Biol., 29 Ormonde Park, Finaghy, Belfast, Northern Ireland.
1952 Sparks, B. W., M.A., F.G.S., F.R.G.S., Department of Geography, Downing Place, Cambridge.
1956 Staadt-Staid, J. E., 123 rue Clovis, Rheims, Marne, France.
1903 H Stelfox, A. W., A.L.S., M.R.I.A., 21 Tullybrannigan Road, Newcastle, Co. Down, Northern Ireland.
1942 P Stratton, L. W., Northcote, South Common, Redbourn, Herts.

1958 (Stuttgart) Staatliches Museum für Naturkunde, Schloss Rosenstein, Stuttgart O, Germany.
1955 Swan, H. D., M.P.S., 48 Loose Road, Maidstone, Kent.
1950 Swaneveld, C., 41 Woodlands, Highstead Road, Rondesbosch, C.P., South Africa.
1907 L Thornton, H. G., D.Sc. (*address not known*).
1958 Tiffin, A. W., Box 1501 M, G.P.O., Adelaide, South Australia.
1949 Tromsø Museum (Zoologisk Ard.), Tromsø, Norway.
1946 L Turner, A. H., F.Z.S., Forest Drove, Bickenhall, Hatch Beauchamp, Taunton, Somerset.
1958 Turner, Miss R. D., Museum of Comparative Zoology, Cambridge 38, Massachusetts, U.S.A.
1938 L Van der Schalie, Henry, A.B., M.S., Ph.D., Museum of Zoology, University of Michigan, Ann Arbor, Michigan, U.S.A.
1946 Venmans, Dr. L. A. W., Nieuwstratt 36, Moergestel (N-B), Holland.
1943 Verdcourt, B., Ph.D., East African Agricultural Forestry Research Organisation, P.O. Box 5166, Nairobi, Kenya.
1927 Wales, National Museum of, Cardiff.
1958 Walker, C. W. (*address not known*).
1954 Wallis, A. J., 13 Raincliffe Avenue, Scarborough, Yorkshire.
1931 L Waterston, A. R., B.Sc., O.B.E., F.R.S.E., Royal Scottish Museum, Edinburgh 1.
1928 White, Miss K. M., M.Sc., Ph.D., F.L.S., Glastonbury, Boyn Hill Avenue, Maidenhead, Berkshire.
1950 Whitworth, J. C. A., B.A., St. Ann's, Elvetham Road, Fleet, Hants.
1953 Williamson, M. H., M.A., 14 Gayfield Square, Edinburgh 1.
1957 Woodgate, Miss G. (*address not known*).
1958 Woodward, F. R., 49 Bunbury Road, Northfield, Birmingham 31.
1947 Zarate, Dr. A. O. de, Najera, Prov. Logroño, Spain.
1937, 1950 Zilch, Dr. A., Senckenberg Museum, Senckenberg Anlage 25, Frankfurt-am-Main, Germany.

Geographical Distribution of Members

ENGLAND.

Berkshire : Hawkins, Lady Iliffe, Quick, Miss White.
Birmingham : Cribb, Pellow, Woodward.
Buckinghamshire : Arkell, Badcock, Dawson, Salisbury.
Cambridgeshire : Sparks.
Cheshire : Mrs. McMillan, Millott.
Cornwall : Adams.
Derbyshire : Jackson.
Devonshire : Hume, Marine Biol. Ass., Nicholson.
Dorsetshire : Belcher, Bloomer, Lang.
Durham : Lowe.
Essex : Comfort, Huggins, Mrs. J. Ll. Jones.
Gloucestershire : Grensted.
Hampshire : Beeston, Brown, V. A. G., Burton, Whitworth.
Hertfordshire : Glennie, Lloyd-Evans, Miss Palmer, Stratton.
Isle of Wight : Prebble.
Kent : Biggs, Burchell, Cozens, Dyke, Langmead, Richardson, Swan.
Lancashire : Dearing, Duckworth.
Leicestershire : Leicester City Museum.
London : Carmichael, Castell, Coxhead, Dance, Fletcher, Galbraith, Geological Survey, Miss Hanna, Hopwood, Janson, Jones, H. F., Kerney, Machin, Nature Conservancy, Pain, Rees, Shuttleworth.
Middlesex : Crowley, Curry, Sarony-Frye.
Norfolk : Mrs. Paton, Peake.
Nottinghamshire : Brown, D. E., Miss Crowley, Pitchford.
Oxfordshire : Cain, Chancellor.

SOMERSET : Cooke, Cousins, Turner, A. H.
SUFFOLK : Laidlaw.
SURREY : Mrs. Ainsley, Miss Davies, Mrs. Davis, Diver, Ellis, Greenish, de Havas, Miss Howard, Scase, Mrs. Sheppard.
SUSSEX : Barnacle, Blok, Goodchild.
WARWICKSHIRE : Ingram.
WILTSHIRE : Raffray.
WORCESTERSHIRE : Bishop.
YORKSHIRE : Appleyard, Bartolomé, Colville, Kay, Lumb, Mrs. Morehouse, Robinson, Wallis.

WALES : National Museum, University College of North Wales.

SCOTLAND : Groundwater, Hunter, Kevan, Rendall, Waterston, Williamson.

NORTHERN IRELAND : Belfast Museum, Bowden, Mrs. Jope, Macdonald, Skillen, Stelfox.

IRISH REPUBLIC : Atkins.

EUROPE.

CZECHOSLOVAKIA : Ložek.
DENMARK : Copenhagen Univ. Zool. Mus., Mandahl-Barth, Schlesch.
FRANCE : Kisch, Staadt-Staid.
GERMANY : Boettger, Bolling, Stuttgart Museum, Zilch.
HOLLAND : Amsterdam Zoological Museum, Mrs. Van der Feen, Nederlandse Malac. Veren., Venmans.
ITALY : Ist. Ital. Idrobiologia, Malatesta.
NORWAY : Tromsø Museum.
POLAND : Feliksiak.
SPAIN : Zarate.
SWEDEN : Laufeld, Liliefelt.
SWITZERLAND : Forcart.

ASIA.

BURMA : Anderson.
INDIA : Prashad.
JAPAN : Azuma.
PAKISTAN : Zoological Survey.
SARAWAK : Harper.
SAUDI ARABAI : Mrs. Grantier.

AFRICA.

ETHIOPIA : Hemming.
KENYA : Robson, Verdcourt.
SOUTH AFRICA : Barnard, Mrs. Boswell, Kennelly, Koch, McGregor Museum, Port Elizabeth Museum, Rombouts, Swaneveld.
ZANZIBAR : Mrs. Mehta.

AMERICA :

BRAZIL : Lopes.
UNITED STATES : Baily, Barker, Bartsch, Berry, Burch, Clench, D'Attilio, Drake, Haas, Jacobs, Johnson, San Diego Nat. Hist. Soc., Miss R. D. Turner, Van der Schalie.

AUSTRALASIA :
  AUSTRALIA : Australian Museum, Mrs. Elliott, Gabriel, Tiffin, Griffiths.
  TASMANIA : Guiler.

ACCOUNTS FOR THE YEAR ENDING 31 DECEMBER 1958.

Income and Expenditure Account.

Dr.

	£	*s.*	*d.*	£	*s.*	*d.*
To Annual Subscriptions—						
,, Paid in 1957	6	18	4			
,, Arrears	41	10	0			
,, Current	159	16	4	208	4	8
,, Sales, etc.				152	1	2
,, Donation . . .				5	0	0
,, Cheque refund . . .					1	0
,, Dividends and Interest :—						
	14	0	0			
	14	0	0			
	40	17	7	68	17	7
				£434	4	5

Cr.

	£	*s.*	*d.*	£	*s.*	*d.*
By Publication and Distribution—						
Vol. 24, pt. 7	148	10	7			
Authors' reprints . .	23	7	0	171	17	7
Vol. 24, pt. 8	104	10	5			
Authors' reprints . .	23	0	0	127	10	5
,, Despatch of parts				11	6	4
,, Printing and Stationery . .				20	12	3
,, Officers' Expenses				10	8	6
,, Postage, etc.				3	10	0
,, Refundment of Subscriber's overpayment				1	0	0
,, Dividends and Interest to Research Fund				30	17	7
Balance, being excess of Income over Expenditure to Balance Sheet .				57	1	9
				£434	4	5

Research and Reserve Fund.

	£	*s.*	*d.*
To Amount of Fund, 1 January 1958 . .	435	3	7
,, Dividends and Interest	30	17	7
	£466	1	2

	£	*s.*	*d.*
By Amount of Fund, 31 December 1958 . .	466	1	2
	£466	1	2

Life Membership Fund.

	£	s.	d.		£	s.	d.
To Amount of Fund, 1 January 1958	569	14	0	By transfer to Income and Expenditure Account	24	0	0
,, Dividends and Interest	24	0	0	,, Amount of Fund at 31 December 1958	569	14	0
	£593	14	0		£593	14	0

BALANCE SHEET

Liabilities.

	£	s.	d.	£	s.	d.
Annual Subscriptions paid in advance				29	13	0
Life Membership Fund				569	14	0
Research Fund				466	1	2
Capital Stock				800	0	0
Balance from Income and Expenditure Account—						
As on 1 January 1958	481	10	2			
For 1958	57	1	9	538	11	11
				£2,404	0	1

Assets.

	£	s.	d.	£	s.	d.
4% Funding Loan (cost)	350	0	0			
2½% Defence Bonds (cost)	200	0	0			
3½% War Loan (cost)	40	0	0			
3½% Defence Bonds (cost)	800	0	0	1,390	0	0
Cash—						
At National Provincial Bank	288	5	8			
,, Post Office Savings Bank	720	14	5			
In hand, Secretary	5	0	0	1,014	0	1
				£,2404	0	1

NOTE.—Assets in addition to those set out in the above Balance Sheet are stocks of unsold publications.

Examined and found correct.
S. P. DANCE,
M. MAITLAND HOWARD } *Auditors.*
10 *March* 1959.

C. A. RAFFRAY.
Hon. Treasurer,
14 *January* 1959.

CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND

Subscription : £1 per annum. **Entrance fee,** 10s.

Meetings are held at the British Museum (Natural History), by permission of the Trustees, at 2.30 p.m., usually on the third Saturday of each month from October to May. Field Meetings are also held.

The Journal of Conchology is issued free to Members. Back numbers are obtainable from the Hon. Secretary, Mr. C. P. Castell, Department of Geology, British Museum (Natural History), Cromwell Road, London, S.W. 7, and from Mr. David Nutt, 156 High Holborn, W.C. 1.

Special Numbers : *Roebuck Memorial Number*, 1921 (Census of British land and freshwater Mollusca), 5s. *Boycott Memorial Number*, 1951 (Census of the distribution of British non-marine Mollusca), £1. *The British Marine Mollusca*, by R. Winckworth, 1932, 7s. 6d. All post free. Members receive a discount of 25 per cent.

Further information and nomination forms may be obtained from the Hon. Secretary.

Malacological Society of London

Hon. Sec. : MISS JOYCE RIGBY, Department of Biology, Queen Elizabeth College, London, W. 8.

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CONTENTS.

PAGE
Officers and Council for 1960–61 . . . 377
On the distribution and synonymy of *Strophocheilus* (*Megalobulimus*) *lichtensteini* (Albers)—T. Pain . . . 378
Mollusca from Prehistoric Jericho—H. E. J. Biggs . . . 379
A preliminary list of the marine Mollusca of Ras Tanura, Persian Gulf—H. E. J. Biggs and Mrs. L. L. Grantier . . . 387
Records of Veronicellidae from East Africa—B. Verdcourt . . . 392
Mon-marine Mollusca in north-east Scotland, with special reference to *Helix hortensis* Müller—Mrs. N. F. McMillan . . . 393
Hygromia hispida (L.) on Hoy, Orkney—Mrs. N. F. McMillan . . . 395
Hygromia hispida (L.) at Stromness, Orkney—W. Groundwater . . . 397
Hygromia liberta (Westerlund) and *H. hispida* (L.) living together—H. E. Quick . . . 397
The rediscovery of *Guivillea* Watson—K. H. Barnard . . . 398
Limax (*Lehmannia*) *poirieri* Mabille near Reading—H. E. Quick . . . 398
Further Scottish records of *Potamopyrgus jenkinsi* (Smith)—D. K. Kevan 399
Anodonta minima Millet in Monmouthshire—F. R. Woodwörd . . . 401
The genus *Charitodoron* Tomlin, 1932—K. H. Barnard . . . 402
Planorbis (*Anisus*) *vorticulus* Troschel in the Thames valley—M. P. Kerney and F. May . . . 403
The twenty-fifth anniversary of the Netherlands Malacological Society—S. P. Dance . . . 405
Monacha cantiana (Montagu) in Fife—Mrs. N. F. McMillan . . . 406
Hugh Watson—B. Verdcourt . . . 407
Agriolimax laevis andicolus (Orbigny) in Nairobi, Kenya—B. Verdcourt . 410
Proceedings: 17 Oct., 21 Nov., 12 Dec., 1959; 16 Jan., 20 Feb. (Annual Meeting), 1960 . . . 413
Reviews . . . 416
Gyrina gigantea (Lamarck) in New Zealand waters—S. P. Dance and R. K. Dell . . . 418
Hygromia subrufescens (Miller) and *H. subvirescens* (Bellamy) living together—H. E. Quick . . . 418
Accounts for 1959 . . . 419

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ON THE DISTRIBUTION AND SYNONYMY OF *STROPHOCHEILUS (MEGALOBULIMUS) LICHTENSTEINI* (ALBERS)

By T. Pain

(Read before the Society, 16 January 1960)

When dealing in 1948 with this then inadequately known Peruvian species, Dr. J. C. Bequaert (*Bull. Mus. Comp. Zool. Harvard*, **100**, No. 1, Monograph on the *Strophocheilidae*, pp. 86–9, pl. 1, fig. 1 ; pl. 3, fig. 1 ; pl. 4, fig. 2 ; pl. 10, fig. 4), retained the closely allied *S. semimalleatus* Fulton (1905, *J. Malac.* **12**, 24, pl. 6, fig. 2, Peru) as a subspecies of it, noting (1948, 89) that *semimalleatus* differs from typical *lichtensteini* only in being relatively much broader, with the body-whorl more swollen and the aperture somewhat wider in proportion to its length. The sculpture is the same in both forms.

In his list of specimens examined, Bequaert refers specimens collected by Dr. Weyrauch at Jaén, Dept. Cajamarca, 900 m., to sub-species *semimalleatus*, but he calls attention to one of these shells, which he says is more slender than the others and is clearly transitional to *lichtensteini.*

Dr. Weyrauch (*in litt.* 1959) informs me that he has collected some 200 bleached shells of *S. lichtensteini* near Jaén, 600–700 m., on the highway to Bellavista. These specimens show considerable variation, and he is unable to find any difference between them and specimens he has collected at Bellavista and from other localities in affluent valleys of the Marañon. Bellavista is in fact the locality recorded by Bequaert (1948, 87) for typical *lichtensteini.*

After examination of shells from both Jaén and Bellavista, I am in complete agreement with Dr. Weyrauch that *semimalleatus* Fulton, 1905, should be considered as a synonym of *lichtensteini* Albers, 1854.

These two localities are situated on a plain covered with dry savannah forest and are only 19 km. apart from each other. Though Jaén is at 700 m. altitude and Bellavista at 400 m., their fauna is identical. The locality " Chanchamayo ", often given in literature for *semimalleatus*, is almost certainly erroneous, since the Chanchamayo valley, only some 700 km. distant from Lima, is covered with subtropical and tropical rain-forest, where such a typically dry-climate species as *lichtensteini* could never occur. Dr. Weyrauch, who has spent a total of some two years in the course of the last twenty collecting in the Chanchamayo Valley, further informs me that he has never seen any trace of it there. All the available evidence points to this species being confined to the dry savannah forest of the valleys of the Upper Marañon, in the province of Jaén.

A complete synonymy together with excellent figures is given by Bequaert (1948). The type of *S.* (*M.*) *lichtensteini* (Albers) is in the Berlin Museum, that of *semimalleatus* Fulton is not in the British Museum and must be considered lost.

MOLLUSCA FROM PREHISTORIC JERICHO

By the Rev. H. E. J. Biggs, F.L.S.

(*Presidential Address, delivered 20 February* 1960)

The British School of Archaeology in Jerusalem made extensive excavations on the site of old Jericho known as Tell-es-Sultan, which lies close to the modern city of Jericho now in the Kingdom of Jordan. The work covered the years 1952 to 1958. Dr. Kathleen Kenyon, the Director of the School, has entrusted to me the Mollusca found on the site, to be examined and reported upon. The marine Mollusca were all purposeful importations to the town, either from the Mediterranean or Red Seas, by man with some human use or activity in mind. These will be the subject of a report which I shall make to Dr. Kenyon and which will be published in due course, it is hoped, as an appendix to one of her volumes of reports on the excavations.

The land and freshwater material is, however, of little or no archaeological interest, but is, to my mind, of considerable conchological interest, and so, with Dr. Kenyon's permission, I am taking this opportunity of putting before you some of my findings.

Now there are one or two points we must consider before dealing with the actual material. The first is that one has to remember that there is always the possibility of a chance introduction of a shell into a site. For instance one shell was marked on the envelope in which it had been placed by the excavator, "JpD.204.2 i. Tunnel -near skull E." This was an example of *Melanopsis praemorsa* L. and it not only had its periostracum intact but the operculum was present and there was some animal matter in the shell. It seems that some worker must have brought water from the well and dropped the shell unintentionally whilst excavating work was going on.

Again we must not overlook the fact that burrowing mammals may open a hole into which rain-water could wash a surface shell. They themselves may take down shells to consume and then later the hole may become filled in. For instance, from the shaft of Tomb P.16, which is of Middle Bronze age, were collected six examples of *Leucochroa candidissima* Draparnaud var. *heirochuntina* (Boissier) L. Pfeiffer. This is a very common species living to-day. All six are eaten away in precisely the same place on each shell; one has the remnants of an epiphragm. Besides this, the colour and condition of the surface suggest a recent shell. From Tomb P.20 of Early/Middle Bronze age come seven of the same species, together with one *Xerocrassa seetzeni.* Here three are eaten away as in the previous instance, but the shells look more like those which are genuinely ancient. These have a "matured" look about them and the colour approaches buff. In this second case also one shell has the epiphragm. I have seen examples of *Obelus galalaensis* Pallary, attached to bushes in the desert east of Cairo, eaten in the same place as the above shells. It was presumed, from the height of these shells up the bushes, that they had been eaten by foxes.

Secondly, it is not absolutely certain that each worker collected every shell he or she saw. It may be that they just took a fair sample of those present in a given stratum, so that too much emphasis must not be placed on mere numbers. At the same time I do feel that we have a very fair picture of the relative abundance of each species and, broadly speaking, we can accept the figures.

Let us now examine the material to hand species by species.

Helix (*Helicogena*) *salomonica* Naegele

The material available is not extensive but very interesting. There are eighty-two examples dated and of these seventy-five are from the Pre-Pottery Neolithic period, one from Pottery Neolithic, two Early Bronze, three Early/Middle Bronze, and one from Middle Bronze. Now *salomonica* is a fairly large shell, and I presume that primitive man would know that as such it would be a cause of weakness in his building or in his bricks, allowing a split to form easily. He would therefore throw it out. Those we have here came into the city for some other purpose and I suggest they were brought in as food. I say this in spite of the fact that one small shell was found in brick fragments of Early Bronze date.

The figures given above show that it was in the Pre-Pottery Neolithic period that most of the shells came into the town, but not one of them shows signs of burning, so they were not roasted. Could they have been boiled ? If so in what sort of vessel ? I have had the privilege of seeing and measuring large numbers of this species from the excavations at Jamo in northern Iraq, which is a site comparable in age with these Jericho shells. They are noticeably larger shells, probably a different race or strain. But in this latter case also there is no sign of burning and there are such vast numbers on the site that they could not be a chance accumulation, but must be kitchen middens.

Levantina spiriplana (Olivier) s.sp. *transjordanica* Rolle and Kobelt

In this case the material available is much more extensive. There are 181 examples excluding fragments, and some are in a most remarkable state of preservation. Of these twenty-seven are in ones and twos, but one lot comprises eleven examples, another fifteen, and a third eighty-six. I am told that this latter batch were not all found together in one place. The excavator's reference number is JpF 205.1b, so I take it they were not found so very far away from one another. One cannot help feeling that in this case, as with *salomonica*, primitive man would realize that they were a cause of weakness in building and so would discard them, so again we have to suggest that they were used as food. It was suggested to me that snails are forbidden as food to Moslems and this may be an inherited prohibition from pre-Islamic days. I now incline to the opposite view.

I inquired of Professor Norman Anderson, of the London University School of Oriental and African Studies, who is an expert on Moslem law, whether or not snails are unlawful in Islam. He kindly replied, giving a reference to a Moslem theologian, to the effect that snails were *haram* (forbidden). But, he added (*in litt.*) " I am also told by a Palestinian friend that the inhabitants of a nearby village (very close to Jerusalem) were well-known eaters of snails—and were apparently mildly looked down on in consequence ! I do not think there need be any difficulty about the custom having persisted in some parts in spite of the Islamic prohibition ". Another friend writes—" Yes, our servants in Jerusalem used to have snails for their meals. My wife is quite definite about this ".

One of the commonest land snails around Jerusalem is *Levantina spiriplana* s.sp. *heirosolyma* (Boissier) Mousson. It is a large snail and, except for members of the *pomatia* group which I did not find in the area, the largest obtainable in Palestine. It is also a close relation of the subspecies under consideration. I would like to suggest that where a practice persists in defiance of Moslem law that practice is very ancient and deeply ingrained. If that contention is correct, snail eating must be a very old custom and may well go back to prehistoric days. Personally I have little doubt that both *transjordanica* and *salomonica* were eaten by primitive man. In one envelope are, amongst other shells, eight examples of *transjordanica*, and the excavator has indicated on the label that they were from middens.

One other scrap of evidence presented itself. One of the workers has carefully preserved some fragments of shell (which I can refer to no other species but the present) from a grave (JpM 15.6A) and put on the label " from under the mandible of skeleton ". Now there is the chance that being fragments they may have slipped in with the earth, but I doubt if earth would be carried in and placed under a skull. It seems much more likely that one cooked snail was placed in the mouth of the dead person as food for the journey into the next world. I merely give this piece of evidence for what it is worth.

As I wanted to compare these shells from 5500 B.C. with present-day forms, a number were collected for me by a member of the School of Archaeology. These came from Jebel Quruntul (the Mount of the Temptation), very close to the town of Jericho. They are the same. Generally speaking this sub-species is a very small form of *spiriplana.*

Leucochroa spp.

The total number of examples of this genus found in the envelopes is 123 ; they come from all periods. This places the genus as subdominant to *Xerocrassa seetzeni* as it is to-day around Jericho. It is difficult to assign the specimens to the described species and varieties as there seems no clear line, except in certain cases, between the varieties. All one can do at present is to enumerate the varieties which are certainly present.

Leucochroa candidissima (Draparnaud)

The majority belong to this species but it is difficult, on the diagnostic character of the rugosity of the upper whorls, to say just how many should be placed in the var. *heirochunctina* (Bossier) L. Pfeiffer. Undoubtedly this form is present in considerable numbers.

Var. *minuta* Mousson. This again is a fairly common variety and seems to come from the Early and Middle Bronze age. One measures 14·2 mm. breadth by 9·5 mm. height.

Leucochroa boissieri Charpentier

This species is represented by only one shell, and that of the form *minor* Westerlund. It is from the Pre-Pottery Neolithic period.

Xerocrassa seetzeni [(Koch) L. Pfeiffer]

This species was the dominant land species in past days as it is to-day in the area. There are 355 examples in the material under investigation. Of these 247 are of the pure white form and 108 of the variety *fasciata* Mousson. The species occurs in all strata. These figures give a proportion of roughly 70 per cent white and 30 per cent *fasciata*. This may be a fair picture of the proportion of the two forms in the past. Unfortunately my own collecting in the area round the Inn of the Good Samaritan in 1939 does not make a good comparison, as I was travelling by car and could not stop long, so selected the largest and most attractive shells I could see. One would need to see much larger numbers unselected to know the exact proportions to-day. In Iraq to-day in the northern part of the country the proportion of pure white to fasciated is very much higher. I believe this to be a drier area.

Most of the representatives of the species were in small numbers, mostly in ones and twos, but one tin contained exactly 100 from a stratum dated about 5500 B.C. Of these fifty-four were pure white and forty-six banded : a higher percentage than anywhere else and higher than the overall total. Darker forms of Mollusca are often associated with warmer and damper habitats, and it is just possible that about 5500 B.C. the climate of Jericho was slightly warmer and damper, but none who know the place can envy those who had to live in it. On the other hand, in view of the susceptibility of molluscs to micro-climates, it may be that we have here shells from a small " pocket " where the conditions suggested prevailed, but not over the whole countryside. If that is so we must postulate that the builders went further afield on this occasion for their earth, which I very much doubt.

Xeropicta langloisiana (Bourguignat)

Less than twenty examples of this species present and they vary very considerably in size. I am grateful to Dr. E. Binder of Geneva for his kindness in determining some of these examples.

Helicella spp.

There are several dozen small shells from all the strata from Pre-Pottery Neolithic to Middle Bronze age which, I must confess, up to the present I have been quite unable to determine. Some appear to be very near *canina* Ancey.

Monacha obstructa (Férussac)

A few examples in most of the strata, and very well preserved in spite of their age. I do not consider them intruded examples. They are all true *obstructa*, with no *schotti* affinities.

Petraeus lamprostatus (Bourguignat)

In Tomb F.3 of Early Bronze age there are a number of specimens of *Petraeus*. One is, in my opinion, of this species although a small form. It is also very fresh and I am a little doubtful as to whether or not we have here another example of an intrusion. The other eight damaged examples have all lost the upper whorls and it is largely by judging the proportion of the body whorl to the spire as well as by the angle of the mouth one determines this species. It is to be noted that all are damaged in the same way ; this may be attributable to all having been submitted to the same conditions which caused the fracture or it may be that they were eaten by burrowing mammals.

Petraeus cf. *damascensis* Pallary

The only other complete example of a *Petraeus* in Tomb F.3 is not of the same species as the others and I am fairly sure should be referred to *damascensis* Pallary. In this case the example does look as if it were a very old specimen.

Cecilioides sp.

One example of this genus was washed out of an example of *Melanopsis praemorsa* of Middle Bronze age, i.e. 1900/1580 B.C. At present it is impossible to name this shell precisely ; one awaits the work of some young student who will bring some sort of order to the described species of *Cecilioides* of the Near East.

I found one example of a species of *Cecilioides* amongst a large number of *Melanopsis doriae* Issel collected at Nain in Central Persia. It seems that this subterranean shell gets washed out of its native habitat and finds a safe lodging in dead shells of *Melanopsis*.

Melanoides tuberculata (Müller)

This species is very common in the Near East to-day and it is surprising that there are only thirty-five examples from the excavations. Even if one allows for the slightly greater friability of this species as compared with *Melanopsis praemorsa*, there still should not be such a wide difference between the comparative number of these two species. One is tempted to suggest that there is here some indication that about 5,000–7,000 years ago this species was not so numerous as it is to-day and that in recent centuries the species is increasing its hold. One example is 39·6 mm. in height ; the largest specimen of this species I have seen so far.

Melanopsis praemorsa (Linné) (= *buccinoidea* Olivier = *laevigata* Lamarck)

This species was represented in the material now reported on by no less than 3,597 examples, more than any other species and ten times more than the next most numerous species, *Xerocrassa seetzeni*. The excavators, when they came across shells at any level in any square, placed them in envelopes of various sizes according to the number and size of the shells. There were no less than ninety envelopes which contained examples of *M. praemorsa* and *X. seetzeni* (or a species of *Leucochora*), and no other shell. It was, therefore, the common practice of the builders at all ages of Jericho to go out to the hillside and gather their earth and then to the stream and gather their water mixing the two; in the latter case scooping up large numbers of *M. praemorsa*. The significance of this point will become clear when we come to deal with *Bulinus truncatus*.

One of the significant features of these shells is that, with a very few exceptions, every shell is coloured orange on the spire and upper third of the last whorl and cream or buff on the lower two-thirds. This character is not very obvious with fresh shells unless held to the light, when the dark area is seen.

The majority of the specimens from the excavations are of medium size and compare well with those from near the site to-day; a long series was kindly sent by the British School of Archaeology in Jerusalem for me to compare. Here again we have a species which has not changed through the centuries. There are, however, a very few which are exceptionally large, the largest being 31·0 mm. × 15·5 mm.

Melanopsis costata (Olivier)

Material available: seven examples, *c.* 5500 B.C.; one damaged example, 2100–1900 B.C. This latter example was found in a tin containing seventy-two specimens of *M. praemorsa*; its presence there as a solitary example of the species is difficult to account for. All the examples are comparable with those inhabiting the Lake of Galilee to-day, and not like the ribbed form of *M. praemorsa* which occasionally turns up when a long series of the species is collected from one place. Did Neolithic man occasionally bring water from some distant source where *costata* lives and with it a shell or two? If so he must have gone as far as the Jordan River, four and a half miles away.

Bulinus truncatus (Audouin)

I washed the earth from a large number of examples of *M. praemorsa* which Dr. Kenyon dates at about 1650 B.C., that is in the Middle Bronze age. In the residual earth, carefully sifted, were a number of small fresh-water shells, including one example of this species in the juvenile state. The preservation of such a friable mollusc is entirely due to the fact that it was washed into the dead *praemorsa* before it was gathered up, by chance, in the vessel in which Bronze Age man carried his water from the source to where he was building. *B. truncatus* is, to-day, one of the commonest vectors of the disease schistosomiasis in man, which is caused by a parasitic worm in the blood stream. This worm passes through a certain stage of its development in the snail. I am grateful to Dr. C. A. Wright, an expert both on the snails and the disease, not only for confirming the determination but for adding the following valuable information (*in litt.*).

" The strain of *B. truncatus* living in Palestine to-day is infectable with the Israeli strain of *Schistosoma haematobium* (Bilharz, 1852), the trematode parasite which causes urinary schistosomiasis. If the Palestinian strain of snail is exposed to *S. haematobium* from Egypt it is possible to obtain an infection rate of 30 per cent amongst the snails. If the Iraqi strain of parasite is used the infection rate falls to about 4 per cent, and the snails prove completely resistant to the Moroccan and Yemeni strains of the parasite. This, I suggest, indicates a well-balanced relationship between the Palestinian snail and parasite, probably resulting from long association between the two."

It is therefore highly probable that Middle Bronze Age man suffered from schistosomiasis in 1650 B.C. For any degree of certainty we must await further evidence from some other quarter. But as Dr. Wright points out (*in litt.*), it depends how much Bronze Age man had contact with water. From the fact that freshwater molluscs occur at all levels and in bricks and walls, I assume he did have very considerable contact with water and possibly fished. I am still in some doubt on this point, as I am not sure whether to suggest that some barbed fragments of cowrie shell found at some levels are fish-hooks or that they were used as buckles.

If the contention is correct, namely that about 1650 B.C. the inhabitants of Jericho suffered from this parasite, it is not by any means impossible that at the time of the fall of the city of Jericho to Joshua, in the middle of the fourteenth century, they were also sufferers. The listlessness and apathy, common to sufferers from schistosomiasis, would have made them careless and inattentive to the repair of the city walls. The more virile and parasite-free desert dwellers were more than a match for the inhabitants of old Jericho and it fell to the invaders as much from a medical reason as a military one.

I have been much exercised in mind as to whether or not it was a vain hope that supporting evidence might be found. Recently it was suggested to me that, in view of the form of the ova of *Schistosoma haematobium* and also of their " toughness ", it might just be possible that traces of them might be found if earth were collected from under a skeleton of Bronze Age man from the place where the bowels would have fallen when they decomposed after death.

Theodoxus macrii (Sowerby)

Quite a number of examples of this species washed from *Melanopsis praemorsa* of the Early and Middle Bronze ages. They are of all sizes from very young shells to fully adult, although the latter are much scarcer.

Bythinella sp.

In almost every batch of *M. praemorsa* washed there occurs in the resulting earth a number of small freshwater gastropods, which I cannot place except in the above genus and that with many reservations. No conchologist whom I have consulted so far is able to give a suggestion even as to the genus, let alone species, to which these minute specimens might be referred.

Unio terminalis Bourguignat

There is a single valve of a *Unio* from JpE.103.17, Early Bronze age. It is a young shell and is, with some reserve, referred to this species, which is quite common in the Near East.

Unio tigridis Bourguignat

A damaged single valve from JpE.119.12a, i.e. of Early Bronze age. Again one can only tentatively place this specimen under this species.

There are various other fragments of Unionidae in the materials excavated, but I must admit that I have found considerable difficulty in assigning these and the above to species. It seems that some of the enthusiastic writers of the last century have added a number of names to the list of Unionidae of the Near East, the sorting out of which awaits the energies of some young student.

Corbicula fluminalis Müller

Here again we are limited to a single valve (JpF.4.9a) from the Pre-Pottery Neolithic period, as evidence of the existence of the species in the area in that period. The valve before me compares perfectly with some in my collection from the present-day Lake of Galilee.

Pisidium vincentianum Woodward

This is another of the species recovered from the earth washed from examples of *M. praemorsa.* Up to the present one young shell complete and nine separate valves have been found. All these shells come from the Middle Bronze age and one adult valve and four young ones are dated by Dr. Kenyon *c.* 1650 B.C. I am grateful to Mr. S. P. Dance for making the first determination and also to Mr. J. G. J. Kuiper who has, quite recently, confirmed this. This is the first record of the species in a sub-fossil state from Palestine.

Marine Mollusca

Although the marine Mollusca from the site will be dealt with in a separate report, it is well that they should be enumerated here. The species determined so far are as follows :—

Arca noe L.
Glycymeris violacescens (Lamarck)
Cardium edule L.
    ,, *tuberculatum* L.
Donax trunculus L.
Pholas dactylus L.
Murex trunculus L.
    ,, *bandaris* L.
    ,, *anguliferus* Lamarck
Columbella rustica L.
Conus arenatus Bruguière
    ,, *mediterraneus* Hwass
Cypraea spurca L.
    ,, *lurida* L.
    ,, *turdus* Lamarck
Natica didyma Röding
Nerita polita L.
    ,, *albicilla* L.
Nassarius gibbosula (L.)
Dentalium sp.
Terebra sp.

SUMMARY

For the past 7,500 years the general facies of the land and freshwater molluscan fauna of the area round Jericho has remained unchanged, with the possible exception of *Melanoides tuberculata* (Müller), which may have increased in numbers.

The general ecological environment and the meteorological conditions in which this fauna lived has also remained much the same throughout the period, with the possible exception that in the Pre-Pottery Neolithic period warmer and damper conditions may have prevailed.

A PRELIMINARY LIST OF THE MARINE MOLLUSCA OF RAS TANURA, PERSIAN GULF

By the Rev. H. E. J. Biggs, F.L.S., and Mrs. Leona L. Grantier

(*Read before the Society*, 12 *December* 1959)

Ras Tanura is in Al Hasa Province of Saudi Arabia, and lies approximately in Lat. 26° 10′ N. by Long. 50° 10′ E. It is a finger-like spit about 10 km. in length running out into the Persian Gulf in a south-easterly direction. This spit forms the eastern side of Tarut Bay and is mostly sandy, but with areas of rock here and there. It is on the bay side of the spit (i.e. western side) where most of the shells enumerated here have been collected. On the Gulf side of the spit the shore, although paralleled by a reef, deepens sharply, so that live shells are found there only in the few areas where the beach is shallow and rocky. The examples recorded here were collected during the years 1958 and 1959.

The height or length given for most species represents the measurement of the largest example taken so far.

GASTROPODA

Diodora funiculata (Reeve): under rocks between tides: 4 cm.

Stomatella elegans Gray: two living examples found on underside of a rock on the bay side. Melvill and Standen record the species for rocks at Karachi, so this is probably the first record for the Persian Gulf.

Euchelus asper (Gmelin): found commonly on rocks between tide lines: 2·3 cm. in height.

Cantheridus kotschyi (Philippi): on rocks between tide lines. Very little variation in colour: 2·3 cm.

Monodonta canalifera (Lamarck): fairly common: 2·5 cm. Some variation in pattern of the markings.

Trochus erythraeus Brocchi: found commonly on rocks between tide lines; no colour variations: 3·1 cm.

Stomatia (*Stomatia*) *phymotis* Helbling: two living examples found on shaley bottom near low tide mark on the bay side. Melvill and Standen record the species for Karachi only; this is probably the first record for the Gulf itself.

Umbonium vestiarium (L.): found in quantity at one time buried in sand between tide lines on bay side: 1·3 cm. Markings vary from pink to light brown. Dead shells are fairly common.

Turbo radiatus Gmelin: found on rocks below tide line, but not common: 6·0 cm. Smaller examples occur on the bay side and have the operculum of a paler colour.

Turbo coronatus Gmelin : on rocks between tide marks : 3·3 cm.

Nerita albicilla L. : rarely on rocks between tide marks.

Planaxis sulcatus Born : found in colonies on rocks at high tide mark, common : 2·0 cm.

Cerithium fasciatum Bruguière : buried in sand near low tide line, common : 6·7 cm.

Cerithium petrosum Wood : as above species : 1·9 cm.

Cerithium morus (Lamarck) : fairly common : 3·2 cm.

Cerithidea (*Cerithideopsilla*) *cingulatus* (Gmelin) : found only occasionally on the bay side.

Xenophora caperata Philippi : rare in the sandy area near low tide line. It generally affixes broken pieces of bivalve shells, but occasionally small gastropods. Although this is the first record of the species in the Gulf, it was collected by Captain Townsend near a locality " K.-i-M." during his 1890–1914 dredgings. These initials probably represent Kuh-i-Mubarak, a locality in the Gulf of Oman from which many other shells were dredged. These specimens are now in the British Museum, and we are grateful to Mr. S. P. Dance for determining our shells and drawing our attention to the Townsend specimens.

Strombus mauritianus Lamarck : found alive occasionally in one location on the bay side ; dead shells are very common.

Strombus fusiformis Sowerby : only one example alive and buried in the sandy spit on the bay side.

Natica lineata Lamarck : found buried in sand between tide lines and fairly common. Melvill and Standen record this for Karachi only, so this is probably a new record for the Gulf.

Eunaticina papilla (Gmelin) : same locality as above : 2·2 cm. Melvill and Standen record this for Jask, so this extends the distribution well to the north.

Cypraea turdus Lamarck : found on both sides of the cape around the rocky bottom : 4·6 cm. There is a wide range of colour from profuse spotting to almost none, and the species is frequently found diseased.

Cypraea caurica L. : fairly common on the undersides of rocks on both sides of the cape near low tide mark : 4·7 cm.

Murex trunculus L. : one recently dead example found.

Murex anguliferus Lamarck : common ; found everywhere except on rocks near high tide line. This voracious animal is frequently found devouring small bivalves. The interior of this species is usually white, but in small animals sometimes lavender : 10 cm.

Murex scolopax Dillwyn : common buried in sand between tide lines ; the largest (13·5 cm.) was, however, taken on the mud flats on the bay side. We are grateful to Mr. R. Tucker Abbott for having determined this shell. Melvill (1928, p. 104) writes : " Gulf of Oman, one, with *M. ternispina* Lam." As this shell has turned up more commonly at Ras Tanura, over forty examples having been taken, may it not be that it has been confused with other similar *Murex* and is really much more widely dispersed in the Gulf than has hitherto been imagined ?

Rapana bulbosa (Solander) : dead shells are fairly common, but only a few living specimens were collected, mainly on mud flats on the bay side: 7·5 cm.

Drupa chrysostoma (Deshayes): two living examples found.

Thais pseudohippocastaneum Dautzenberg: fairly common on rocks near high tide line: 3·8 cm.

Thais carinifera (Lamarck): living shells found occasionally: 3·9 cm.

Thais tissoti Petit: found fairly commonly on rocks between tide lines. Interior colour ranges from cream to orange: 3·6 cm.

Mitrella (*Mitrella*) *blanda* (Sowerby): found commonly on sand, busily moving about just above low tide line. The zigzag markings on this species vary much in intensity of colour and in spacing, some being quite wide apart.

Nassarius pullus (L.): common buried in sand between tide lines. Catination found between this species and the following: 2·2 cm.

Nassarius stigmarius (A. Adams): same locality as above: 1·8 cm. This is probably a new species for the Persian Gulf list. Melvill and Standen record it for Muskat which is, geographically, in the Gulf of Oman.

Fusus sp. Dead shells of this, as yet, unidentified species are fairly common; so far no living shells found.

Ancilla cinnamomea Lamarck: very common; found buried in sand between tide lines: they are mostly of a rich cream colour, and only rarely a dark brown or a cinnamon-coloured example is found: 3·4 cm.

Oliva bulbosa Röding: large examples of 5·0 cm. are found in one spot on the bay side below low tide line. Small examples (3·0 cm.–3·5 cm.) found on the Gulf side buried in sand. Many colour and pattern variations are found.

Conus pennaceus Bruguière: found only on the Gulf side so far and then under rocks on the bottom below low tide level. Dead shells are fairly common also on the Gulf side.

Acteon tessellata Reeve: found on mud flats on the bay side. Not recorded for the Persian Gulf so far, or at least not under this name. Those from Ras Tanura are somewhat different from those referred to as *Acteon* sp. (Biggs, 1959, p. 274), but these latter may be the same species.

Bullaria ampulla (L.): two living examples and a number of dead ones taken.

Siphonaria rosea Hubendick: fairly common on rocks at high tide line: 2·5 cm.

Siphonaria sp.: these shells are tinged with black inside and, although of the same size and from the same locality, are not of the above species.

BIVALVIA

Arca uropigmelana Bory de St. Vincent: found commonly on mud flats on the bay side: 6·0 cm.

Arca (*Acar*) *divaricata* Sowerby: fairly common. It is attached by the byssus to the underside of rocks on both sides of Ras Tanura.

Glycymeris (*Axinaea*) *spurcus* (Reeve): several examples collected on one occasion on the bay side: 2·8 cm. Melvill and Standen record the species for Karachi, so this is a new record for the Gulf.

Glycymeris (*Pectunculus*) *pectunculus* (L.): dead shells are common on the mud flats on the bay side. It is only occasionally collected alive.

Arca (*Barbatia*) *decussata* Sowerby: fairly common in rock crevices.

Mallaeus cf. *regula* (Forskål): on rocky bottom below low tide level; not common.

Isognomon ephippium (L.): Thirteen examples taken so far. They tend to live near low spring tide level.

Pinna strangei Reeve: a large example measuring 32 cm. in length was taken 50 km. north of Ras Tanura. The largest from Ras Tanura itself is 20 cm. New to the Persian Gulf fauna.

Pinctada margaritifera (L.): found on rocky bottoms and reefs below low tide level. Largest is 7·5 cm., but larger examples are taken in deeper water.

Plicatula imbricata Menke: only dead shells found so far. It seems to be fairly common attached to rocks and stationary shells such as *Chama brassica.*

Chlamys ruschenbergerii (Tryon): from rocky bottom and reef below low tide mark and wedged into rocks, not found free swimming. Height of largest 8·6 cm. Determined by Mr. G. Grau of California. This appears to be the first time the species has been recorded for the Persian Gulf.

Modiolus plumescens (Dunker): only occasionally collected. New to Gulf fauna.

Anomia sp. A few living examples collected on rocky bottom at low tide, but dead shells are fairly common.

Cardita cumingii Deshayes: not taken alive so far, but dead shells are fairly common. Typical brown and white pattern found, also some with yellow-brown colour. Melvill and Standen (1906, p. 813) note under this species: "This insertion is made with some slight doubt, and more specimens are required for confirmation." We hope living specimens will be found in future.

Beguina (*Mytilicardita*) *gubernaculum* (Reeve): neither living nor dead shells are common. Melvill and Standen give this species for the Gulf of Oman and Jask; this record extends the known range of the species well to the northwards.

Divaricella dalliana Vanetta: only dead shells found so far. New to the Gulf fauna.

Lucina tumida Reeve: only dead shells so far found. New to Gulf fauna.

Codokia divergens Pfeiffer: only dead shells found so far. New to Gulf fauna.

Chama brassica (Reeve): common on rocky bottom and on the reef below low tide level. Generally it is firmly attached to rocks. Colour varies from purple to orange: 7·7 cm.

Chama aspersa (Reeve): attached to solid objects around or below tide line. New to the Gulf fauna.

Tachycardium lacunosum Reeve: dead shells commoner than living ones; the young ones tend to have a dark patch inside the hinge: 5·7 cm.

Cardium (*Papyridia*) *papyraceum* Gmelin: only three living examples taken so far, buried in the mud flats.

Gafrarium intermedium Reeve: fairly common. Some pattern and colour variation both inside and out: 5·0 cm. New to Gulf fauna.

Gafrarium scriptum (L.): uncommon, only one or two found.

Circe arabica Chemnitz: very common in sandy patches between the rocks and on the mud flats on the bay side of the Ras: 4·6 cm.

Meretrix meretrix (L.): the majority are white, but some are violet; one shades from violet to brown and yet another is entirely brown. Common.

Pitaria (*Macrocallista*) *erycina* (L.): found in quantity in spring, 1959, buried in sand between tide marks: 3·0 cm.

Sunetta effosa Hanley: fairly common buried in sand between tide lines. Largest 3·6 cm., but the average is about 3·0 cm. There is slight variation in the intensity of the colour markings and one shell found was entirely brown. Melvill and Standen give the species for India up to Karachi only, so this is another addition to the Gulf fauna.

Dosinia radiata Reeve: there is some doubt about this determination; it may be *D. histrio*, which is recorded for the Gulf by Melvill and Standen. They do not record *radiata*.

Dosinia ?alta Dunker: not found alive at Ras Tanura so far, only dead shells and these are only taken well out at spring tides.

Eumarcia opina (Gmelin): on mud flats on the bay side: 3·2 cm. A few occur with irregular brown markings near the umbo. The species does not appear to have been recorded for the Gulf before.

Venerupis sulcaria (Lamarck).

Venerupis deshayesi (Hanley).

Mactra lilacea Lamarck var.: one living example only found buried in sand between tide marks.

Mactra fouroti Jousseaume: collected on one or two occasions only, buried in sand: 6·5 cm. This may be a form of *Mactra lilacea* Lamarck, as some of the examples found have slight traces of the radiating lilac lines so characteristic of *lilacea*. The Ras Tanura form is, however, quite white inside. At Balhaf, west of Mukalla (and probably at other places round the S. Arabian coast), there exists a race of this shell which has the outside like typical *fouroti* but a beautiful lilac inside, i.e. intermediate between the true *lilacea* and *fouroti*.

Tellina capsoides Lamarck: Melvill and Standen give the distribution of this species as Karachi and Bombay southwards to Goa. This is the first record for the Gulf.

Asaphis deflorata (L.): found in May and June, 1959, among rocks near low tide line on the bay side: 7·8 cm. The interior colour ranges from cream to yellow and to purple, generally with the purple patch at the adductor muscle scar.

Psamobia occidens Chemnitz: a few living shells collected in sand between tide lines. Melvill and Standen record the species for Muscat, which is geographically in the Gulf of Oman, so this too may be an addition to the Gulf fauna.

Semele sinensis A. Adams : only two living examples and one dead shell found on a sand spit. The species is new to the Gulf fauna.

Solecurtus strigilatus (L.) : two living examples taken.

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RECORDS OF VERONICELLIDAE FROM EAST AFRICA

By B. Verdcourt

(*Read before the Society*, 17 *October* 1959)

The following slugs formed part of a collection sent to the late Hugh Watson, who was unable to find time to work on it. I have now sent portions of the collection to various workers and Dr. Forcart of Basel, Switzerland, has kindly reported on the Veronicellidae. He is adding the records to a paper now in the press, but it seems worthwhile to record the full details of the captures. These are as follows :—

Laevicaulis stuhlmanni atrolimbatus (Simroth)

Kenya, Nairobi, 5,500 feet, July 1951, B. Verdcourt ; in native cultivations on bare volcanic rocks near the Nairobi River ; 49 mm. long and 12 mm. broad ; mottled grey and pale fawn above, densely speckled with minute black dots and pale fawn dots ; fringe yellowish, edged with black ; hyponotum ditto, mottled greyish towards the edge.

Laevicaulis alte (Férussac)

Tanganyika, Tanga, 50 feet, 14 December 1949, B. Verdcourt ; crawling on sandy ground near Tanga cemetery on a hot dry day ; back blackish, foot pale brown, ventral sides of body grey.

Laevicaulis somalicus (Colosi)

Tanganyika, East Usambara Mountains, Amani, 3,000 feet, 26 August 1950, B. Verdcourt ; in rain forest ; 3 cm. long ; upper surface of the animal dark blackish purple, very obscurely speckled and minutely shagreened, no trace of a median band ; ventral sides of the body very pale purple with small black spots ; lower tentacles colourless, upper ones conical, dark purplish apically, save for the extreme tips, which in all four tentacles are very pale brown ; sole colourless, tinged very pale brown, transverse ridges grey.

Laevicaulis zanzibaricus Forcart

Tanganyika, East Usambara Mountains, Sigi Singali (below Amani), 1,500 feet, 22 April 1950, B. Verdcourt ; on a stone in path in rain forest ; a small inconspicuous species with dark purplish body ; there is a pale dorsal band, almost invisible in life.

NON-MARINE MOLLUSCA IN NORTH-EAST SCOTLAND, WITH SPECIAL REFERENCE TO *HELIX HORTENSIS* MÜLLER

By Nora F. McMillan

(*Read before the Society*, 16 *January* 1960)

Since the days of William Macgillivray little attention seems to have been paid to the land and freshwater Mollusca of north-east Scotland. F. Booth (1913a; 1913b) spent a week investigating the molluscan fauna of Aberdeen and Kincardine, and " Robert Dawson, A.M., Cruden " (I believe he was the local schoolmaster) catalogued the Mollusca of Aberdeen, Banff and Moray in 1870.

A short holiday in Cruden Bay in August 1956 and another at Fraserburgh in July 1958 enabled me to add six species to the authenticated fauna of Aberdeen North, and to pay fleeting visits to some Banff and Kincardine localities. Notes on the more interesting species follow. Unless otherwise specified the localities are in Aberdeen North.

Potamopyrgus jenkinsi (Smith). This enterprising snail has now reached Aberdeen North, where it was abundant in a stream at Cruden Bay, also in a marsh behind the shingle bar which blocks the debouchure of the Torr Burn into Cullykhan Bay, Banff, in July 1958. According to Hunter and Warwick (1957, 365), Cove in Kincardineshire was the most northerly record for N.E. Scotland, but it has more recently (*J. Conch.* **24**, 366, 1959) been recorded from Banff, Elgin and Easterness.

Planorbis albus (Müller) and *Segmentina complanata* (L.). A few examples of each in the Loch of Strathbeg. Dawson (1870) recorded both species (his *P. nitidus* Müller is almost certainly *S. complanata*), but no specimens exist to substantiate his record.

Helix hortensis Müller. Special attention was paid to this species to ascertain which colour-forms were present. Yellow 12345 was by far the most abundant in every locality searched (Troup Glen and Cullykhan Bay, Banff; Rosehearty, Fraserburgh, Scotstown, Loch of Strathbeg—all Aberdeen North; and Gourdon, Kincardine). The two Banff localities each yielded a very few bandless yellows, but none save heavily-banded yellows (almost all 12345 banding) were found in the rest of the localities except Cruden Bay. The dunes at Cruden Bay held *H. hortensis* in amazing numbers, and bandless shells appeared to outnumber the banded examples. The scarce var. *olivacea* Taylor was abundant as well as bandless yellows, but no reds, banded or otherwise, were obtained.

One hundred and sixty-four specimens taken at random were as follows: thirty-eight bandless yellows, with white lips; seventy-eight var. *olivacea*, with very pale pink lips (including three banded specimens, one 00300, one 00005 and one with a faint yellowish central band); forty-eight heavily-banded yellow shells, showing some variation in the bandings, but no 00300 present; thirty were 12345.

Booth (1913a) commented upon the occurrence of var. *olivacea* about Cruden Bay and the dominance of the heavily-banded yellows north of Peterhead, just as I found some forty years later. Boycott (1927) mentions var. *olivacea* as having been recorded also from Sutherland and Ross; he also found *arenicola* Macgillivray in its original locality, Black Dog Farm, Belhelvie, Aberdeen South.

Helix nemoralis L. A single fairly fresh shell was taken at Gourdon, on the Kincardine coast one mile south of Bervie, July 1958. The shell is rose-red, banded 12345, and in size and shape is clearly *H. nemoralis*. (In this Mr. Stelfox, who has seen the shell, agrees with me.) Hitherto St. Cyrus, about six miles further south, was the most northerly station for the species on the east coast.

There is, however, an old record for *H. nemoralis* (Taylor, 1853): "Plentiful, at Birse, about 30 miles from Aberdeen, up Deeside; first found there by Mr. Ewan." One might be tempted to dismiss this as a confusion between *H. hortensis* and *H. nemoralis*, but *H. hortensis* is listed separately, and Taylor continues: "I find it [*H. nemoralis*] has the same varieties as *H. hortensis*." Birse is two miles south-east of Aboyne and the record seems to deserve investigation.

Helicella caperata (Montagu). Macgillivray took this species only in Old Aberdeen, but Dawson thirty years later found it plentiful at Cairnbulg (two and a half miles south-west of Fraserburgh). It was abundant on the Cruden Bay dunes in 1956, as well as at Kirktown and Scotstown (both between Fraserburgh and Peterhead) in 1958. It is curious that Dawson did not record it from Cruden Bay, where he could hardly have overlooked it in its present abundance.

Arion rufus (L.). A single large black slug picked up on the roadside at King Edward, six and a half miles north of Turriff, was sent to Dr. H. E. Quick who identified it as *A. rufus*, despite its colour. This is the first Scottish record (see *J. Conch.* **24**, 295, 1958). An arable field bordered the road on one side and rather new gardens on the other, so it is not a truly "wild" habitat.

Arion subfuscus (Draparnaud). Abundant in the marsh at Cullykhan, Banff. New to the county.

Pisidium subtruncatum Malm; *P. nitidum* Jenyns. Both *ex* Loch of Strathbeg, Mr. Stelfox kindly verified my naming of these shells.

DOUBTFUL SPECIES

Anodonta spp. Dawson recorded *A. cygnea* (L.) as abundant in the Loch of Strathbeg, and specimens labelled "Crimond, Strathbeg" exist (or at least did exist when Booth wrote) in Aberdeen University. Macgillivray recorded *A. anatina* from several localities. Neither species seem to have been refound recently, and I saw none on my one brief visit to the Loch of Strathbeg.

Planorbis vortex (L.). Dawson recorded this species as common, but Booth states that there are now no specimens in Aberdeen University, where his collection apparently went (Booth, 1913a, 277–8). In the Arbuthnot Museum, Peterhead, there are three shells labelled "Planorbis vortex ? Cruden 1860". These the Librarian and Curator, Mr. Richard Milne, allowed me to examine. All the shells were in a fragmentary condition, and two were indeterminable, but the least battered looks much more like *P. leucostoma* Millet than *P. vortex*. These shells were almost certainly collected by Dawson, as other species, similarly mounted on old wooden tablets, bear labels " Cruden 1860. Mr. R. Dawson ".

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HYGROMIA HISPIDA (L.) ON HOY, ORKNEY

By Nora F. McMillan

(*Read before the Society*, 17 *October and* 12 *December* 1959)

The history of *Hygromia hispida* (L.) in Orkney is short. On 13 September 1907 A. W. Stelfox took numerous examples under logs near the harbour in Stromness on Mainland, the largest of the Orkney islands. This was so far north of the nearest known localities for the species (Kincardineshire on the east coast and four rather unsatisfactory stations in the Outer and Inner Hebrides), besides the habitat being near a harbour, that the possibility of introduction could not be ruled out. Recently, however, Mr. W. Groundwater has found *H. hispida* living in various places about Stromness and even if introduced originally the species is now well established there.

Exactly fifty years after Stelfox's discovery I was fortunate enough to find *H. hispida* living in what seems to be a thoroughly " wild " habitat on the island of Hoy, the largest of the South Isles of Orkney.

Hoy is a good-sized island, some thirteen by six miles in extent, and quite unlike the other islands of the group. Almost all of it is a range of peaty hills of Upper Old Red Sandstone, rising to nearly 1,600 feet at the Ward Hill in the north. The north-east corner, however, is of the Lower Stromness Flags, and here I found *H. hispida* living in a small isolated sea-glen between Breibuster and Selwick. There are two small glens close together, merely steep clefts in the cliff with a little burn in each. One glen held only *Lymnaea truncatula* (Müller), but the other (that nearer to Selwick) contained a respectable molluscan fauna, despite the lack of all cover except primroses and a little *Geum rivale*. The snails occurred, as far as I could ascertain, only in the steep lower part of the glen; higher up where there was some *Iris pseudacorus* I could find no Mollusca when I searched on 30 August 1959, but it was a very hot day in a very dry season. The species obtained on two visits (17 June 1957 and 9 August 1958) were *Potamopyrgus jenkinsi* (Smith); *Succinea pfeifferi* Rossmässler (*det.* H. E. Quick); *Cochlicopa lubrica* (Müller); *Lauria cylindracea* (da Costa); *Arianta arbustorum* (L.); *Helix hortensis* Müller, fairly frequent, all yellow with five dark bands; *Arion ater* (L.) (*det.* Quick); *Agriolimax reticulatus* (Müller); and *Hygromia hispida* (L.), a total of four adults and one young one taken on the two visits. This is not many, but the cleft is only a few feet across and one visit was cut short by darkness and the other was on a hot dry day. Indeed the glen is so small and bare that it is surprising to find any snails at all in it.

The question of a possible introduction, perhaps with plants for a garden, naturally arose, and therefore on my next visit (on a scorching hot day, 30 August 1959) particular attention was paid to this point.

The nearest relic of civilization is an abandoned shepherd's house (the Fea) about 600 yards inland, and at a height of 188 ft. 6 in. (a benchmark on one of the buildings enables one to be so precise). This croft was abandoned forty-five to sixty years ago. Weeds of cultivation (*Stellaria media*, nettles and docks) linger about the place, but an hour's search among nettles and fallen flagstones only produced *Arion circumscriptus* Johnston (one); *A. ater*, a single grey specimen; *Limax marginatus* Müller (three) and *Agriolimax reticulatus* (six).

The next nearest house (Bridgend) is one-fifth of a mile west and much lower down. Abandoned in 1950, nettles and a few other weeds still survive about it, and a search yielded two *Limax marginatus* and several *Agriolimax reticulatus*—nothing else. Two more abandoned crofts further away were also examined. " Hasses " lies about three-eighths of a mile west and south of the Fea and has not been inhabited within living memory. A nettle-patch nearby did not produce a single slug or snail. Another croft " Groups ", down by the Breibuster Burn, also empty but used as a store, had two *Arion ater* and one *A. hortensis* Férussac among nettles.

The absence of shelled molluscs (not even one old shell was found) from the abandoned crofts nearest to the *H. hispida* glen, while not proof, does strongly suggest that *H. hispida* is native here and not an introduction. Bleak moor, with *Arion ater* and *Limax marginatus* apparently the only molluscan inhabitants, surrounds the two little sea-glens and isolates them almost as thoroughly as the sea would do.

I have gone into some detail as I realize the extreme difficulty of attempting to decide whether a species is native or not, especially in districts such as Hoy, where the tide of civilization and cultivation is receding and leaving abandoned crofts behind it. The *H. hispida* glen certainly looks as wild and " native " a habitat as one could desire and the possibility of introduction via a garden seems remote in the extreme.

My Hoy shells are similar to those collected by Stelfox in Stromness in 1907, and to a shell from Bergen, also taken by Stelfox. All are thin, hairy and rather narrowly umbilicate; two of the Hoy shells measure 8 mm. in diameter by just under 5 mm. in height.

On the Continent *H. hispida* ranges north to 66° in Norway, and there seems no valid objection to its being native in Orkney. The Faroes and Icelandic records quoted by Taylor (1916, 35) from Westerlund (1897, 49) have been disproved, however, by Schlesch (1930) and Mandahl-Barth (1938, 17).

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Hygromia hispida (L.) at Stromness, Orkney.—It is interesting to note that living specimens of this snail were found by Mrs. McMillan in Hoy in the summers of 1957 and 1958. As she has informed me, its only previous known occurrence in Orkney was as recorded by Stelfox, who found the species at Stromness in 1907 " under logs near the harbour ". In the past two years I have found this species in various parts of Stromness. In the summer of 1958, in an effort to determine its range in the Stromness area, I had no difficulty in finding specimens, living and dead snails, in various localities, extending from the south end of the town, near the look-out behind Ness Battery, to the centre, behind the school, and on the Stromness–Kirkwall road in an old quarry a mile to the north of the town. This seems to indicate that the species is fairly common and widespread in this vicinity, and probably has been for a long time. All the localities mentioned are at some distance from the shore. They were found not far from the waysides, among grass, and particularly in bunches of nettles.

W. GROUNDWATER.

(*Read before the Society*, 17 *October* 1959)

Hygromia liberta (Westerlund) and *H. hispida* (L.) living together.—On 19 June 1955 these two species were found living together on the same spot on the bank of the River Thames about one mile above Pangbourne, Berkshire. Since then the site has been levelled by dumping and wired off from the towpath, so it is uncertain whether they still survive there.

H. E. QUICK.

THE REDISCOVERY OF *GUIVILLEA* WATSON

By K. H. Barnard

(*Read before the Society*, 16 *January* 1960)

The 6½ inch Volute *Guivillea alabastrina* Watson was one of the outstanding discoveries of the *Challenger* Expedition. It was taken in 1,600 fathoms between Marion Island and the Crozets: 46° 16′ S., 48° 27′ E., in December 1873. Mr. S. P. Dance has kindly drawn my attention to the record of a specimen taken by the Scottish National Antarctic Expedition near the South Orkneys (Melvill and Standen, 1907, *Trans. Roy. Soc. Edin.* **46**, 140).

In December 1959 Mr. F. H. Talbot, Marine Biologist of the South African Museum, while dredging in deep water off Cape Point, obtained a dead half-grown shell, an apex (protoconch plus two whorls), and the columella of another shell. The approximate locality is 34° S. 16½–17° E., depth 1,470–1,620 fathoms.

The distinctive protoconch is like that of the *Challenger* shell, consisting of one and a half or possibly two whorls, but the junction with the postnatal whorl is not apparent owing to corrosion; the columella has the same rather sharp pleat, producing a kink.

The South African Museum hopes to continue dredging in this area, at greater depths than those sampled by the Cape Government trawler *Pieter Faure* at the beginning of this century. In this and in a previous series of dredgings a most astonishing collection of Mollusca has been obtained, including *Oöcorys*, *Charitodoron*, *Admete*, Trochids, and especially Cytharine Turritids. A shell resembling a *Semifusus* but with a taenioglossid radula, and a small Gastropod combining in its shell, operculum and radula the characters of three families, are enigmas.

***Limax* (*Lehmannia*) *poirieri* Mabille near Reading.**—This greenhouse alien was first recorded for the British Isles under the name *L. valentianus* Férussac in *Synopses of the British Fauna*, No. 8, p. 24 (Linn. Soc., 1949), but had been found in the Botanical Gardens at Belfast on 26 November 1948 by Dr. A. D. J. Meeuse (C. O. van Regteren Altena, 1950, *Zoologische Verhandelingen*, Leiden, No. 11, p. 16). *L. poirieri* has recently been found in considerable numbers in a greenhouse belonging to the University of Reading at Shinfield, Berkshire, together with *Subulina octona* (Brugière). This slug is a native of the Iberian Peninsula, which has been introduced into several countries, including U.S.A., where it was mistaken for *L. marginatus* Müller (Pilsbry, 1948, *Land Mollusca of North America*, vol. 2, p. 530).

H. E. Quick.

FURTHER SCOTTISH RECORDS OF *POTAMOPYRGUS JENKINSI* (SMITH)

By D. K. Kevan, F.R.S.E., F.R.E.S.

(*Read before the Society*, 21 *November* 1959)

Since the publication in 1957 of Hunter and Warwick's paper, " Records of *Potamopyrgus jenkinsi* (Smith) in Scottish fresh waters over fifty years (1906–56) " in *Proc. Roy. Soc. Edin.*, B, **67**, 360–373, and Warwick's subsequent records for the counties of Peebles, Haddington and Berwick (*J. Conch.* **24**, 295), I have found this species in a number of new localities, extending its known range to Wigtownshire in the south-west and the Tweed area in the south-east of Scotland. Mr. A. J. Smith, whose record for Roxburghshire (Williestruther Loch, a Hawick reservoir, October 1959) appeared in the Recorder's Report, 1950 (*J. Conch.* **23**, 123), has kindly given me another record from Selkirkshire which I include below. These new records, grouped as in Hunter and Warwick's paper, are as follows :—

Solway and Borders

Tarff Water, near Tarff, Kirkcudbrightshire, 22 June 1958 : still abundant in the original 1946 locus.

Tarff Water : (1) by Ringford, (2) marshy pools, etc., at the junction with the tidal Dee estuary, 10 November 1958.

Cally Loch, Gatehouse-of-Fleet, Kirkcudbrightshire, 7 November 1958, abundant.

Cally Loch, marshy ditches on the south-west side, 14 November 1958.

Cally Loch, tidal creek at outflow (through underground pipe), 16 November 1958.

Whitefield Loch near Glenluce, Wigtownshire, 13 November 1958.

Cauldshiels Loch, Selkirkshire, 4 August 1959, abundant.

River Tweed, near Yair House, Caddonfoot, Selkirkshire, 25 July and 4 August 1959.

Bowhill Bottom Lake, Selkirkshire, 1950, A. J. Smith.

South of Forth

Union Canal : thirteen stations visited 21 and 23 July 1958, from Woodcockdale, south of Linlithgow (Station I) to Long Hermiston, Midlothian (Station XIII). *P. jenkinsi* was found abundantly at four stations east of Linlithgow, namely :—

Station II : north of Kingscavil, by the road to Philipstoun, West Lothian.
Station IV : south of Philipstoun, West Lothian.
Station VII : south-east of Broxburn, West Lothian.
Station IX : by Clifton Hall, Midlothian.

Carmelhill Reservoir near Kirkliston, West Lothian, and in a water-filled quarry nearby, 26 September 1958, abundant.

Linlithgow Loch, West Lothian, at north-east end of loch, 2 October 1958, abundant.

Water of Leith, west of Balerno, Midlothian, 18 July 1959.

West Midland Valley

Reservoir by the road from Muirkirk, south of Glenbuck, Ayrshire–Lanarkshire border, 29 July 1958.

White Loch near Carnwath, Lanarkshire, 14 August 1958, abundant, associated with *Pisidium lilljeborgi.*

The following observations can be made on the above records :—

(1) Tarff Water. The river flows down from the hills just above Ringford, but I was unable to find any *P. jenkinsi* up-river. From Ringford to the Dee estuary the land is flat, and *P. jenkinsi* seems very strongly established. The marshy pools at the mouth of the river are brackish.

(2) Whitefield Loch. The water was at a very high level, searching proved difficult and time available was short. Only a few specimens were obtained, but doubtless the species is more plentiful in other parts of the loch. I saw no sign of *P. jenkinsi* in the peaty moorland lochs to the east of Whitefield Loch, i.e. Fell Loch, Black Loch, and Hempton Loch, which were visited on 18 November 1958, but it would not be surprising if it were found to be present in the series of lowland lochs to the east of Stranraer, or, even further westwards, in the lochs of the Rinns of Galloway.

(3) R. Tweed, near Yair House. Hunter and Warwick, in their paper, only record one locality in the " Tweed area ", i.e. Hawick Reservoir, Roxburghshire (Mr. A. J. Smith's record as already mentioned). On 25 July 1959 only one specimen of *P. jenkinsi* was taken after two hours' search, and a further one and a half hours on 4 August 1959 only secured two further specimens. It would appear to be a new arrival at this particular *locus*, and it will therefore be very interesting to see if the species is able to colonize this stretch of the river, and how long it takes to do so. The further records of Cauldshiels Loch and Bowhill Bottom Loch furnish additional proof of the spread of *P. jenkinsi* in the Tweed area.

(4) Union Canal. Hunter and Warwick state (*loc. cit.*, p. 366) that *P. jenkinsi* " seems to be extinct through this canal ", but while this certainly appears to be true as far as the eastern end of the canal near Edinburgh is concerned, it is definitely not the case as regards the stretch of the canal from near Ratho in the east to near Linlithgow in the west. *P. jenkinsi* is a strange animal ! It is just as likely to disappear from an apparently well-established *locus* as to appear in a new one, and, not infrequently two such *loci* may be comparatively close to each other. For example, it did not appear to be present at Station X where it was abundant in 1936, but was plentiful at Station IX (Clifton Hall) only a short distance to the west. A negative result from an old *locus* therefore does not necessarily mean that it has completely disappeared from the area.

There has been a considerable change in the molluscan fauna of the Canal since 1936, particularly between Linlithgow and Edinburgh (presumably due to water-pollution) and species now get fewer and scarcer as Edinburgh is approached. *Lymnaea stagnalis* (not present in 1936) is plentiful throughout, while *Bithynia tentaculata* (abundant in 1936) has practically disappeared east of Linlithgow, although still abundant at Station I (Woodcockdale) south of that town. An interesting fact with regard to this species is that I have not so far found it in association with *P. jenkinsi*. The following table illustrates the point.

	B. tentaculata.	*P. jenkinsi.*
Station I (S. of Linlithgow) . .	Abundant	Nil
,, II (E. of Linlithgow) . .	Nil	Abundant
,, III (,,) . .	Present	Nil
,, IV (,,) . .	Nil	Abundant

I did not find *B. tentaculata* at any of the Stations V–XIII, but, as already mentioned in the list of new localities, *P. jenkinsi* appeared at Stations VII and IX. I do not know if this seeming non-association of *B. tentaculata* and *P. jenkinsi* is of any real significance. It may be that the former is more sensitive to water-pollution and, at any rate east of Linlithgow, is just managing to survive in a few isolated *loci* before finally disappearing from the area, but this does not seem to explain the non-association of the two species. *P. jenkinsi* is very prolific and undoubtedly tends to become dominant wherever it appears, and may drive out less tenacious species. It would, therefore, be very interesting to know what changes (if any) *P. jenkinsi* has made on the molluscan populations of English canals, whether it has driven out certain " weaker " species, or whether, after an initial outburst perhaps and subsequent adjustment, a reasonable balance has been arrived at as between the various species.

***Anodonta minima* Millet in Monmouthshire.**—During a visit to the town of Monmouth in June 1955 I searched for Mollusca in the River Wye. On the bank opposite the Monmouth Grammar School for Boys I found several dead shells of *Anodonta*, which had been deposited there during the floods of the previous winter. The river here is fairly shallow, flowing rapidly over rocky ledges. A careful search of this part of the river failed to yield any living *Anodonta*, the only mollusc found being *Theodoxus fluviatilis* (L.). Subsequent investigations revealed a small colony of *Anodonta* inhabiting a region of calmer water on the downstream side of the town bridge, which is on the Monmouth–Lydney road. The colony was situated amongst the compacted refuse of twigs, etc., which had accumulated along the bank at this place. The water was very clear, about 6 feet deep. The *Anodonta* did not seem to be present in the silty deposit on the river bed, but restricted to the mass of debris. On looking through my collection in December 1959 I came across a specimen of *Anodonta minima* collected in 1955 in this locality. The identification has been confirmed by Mr. A. E. Ellis.

F. R. WOODWARD.

THE GENUS *CHARITODORON* TOMLIN, 1932

By K. H. Barnard

(*Read before the Society*, 21 *November* 1959)

Tomlin (1932, *Ann. S. Afr. Mus.* **30**, 167) instituted the genus *Charitodoron* for three species from deep water off Cape Point. In 1943 (*J. Conch.* **22**, 50) he added a fourth species. He placed the genus in the *Buccinidae* on conchological grounds, no animal of any of the species being available. In 1959 (*Ann. S. Afr. Mus.* **45**, 146) I suggested that one of Tomlin's species (*aglaia*) was a synonym of *Columbella agulhasensis* Thiele, 1925; and in the same paper (p. 51) the remarkable resemblance of *Mitra* (*Dibaphus*) *bathybius* Barnard to *Charitodoron pasithea* was noted. Recently deep-water trawling off the Cape Point has brought up living examples of *Charitodoron thalia* and *pasithea*. Both have a radula similar to that of *bathybius* (loc. cit., fig. 11c), proving that they belong to the *Mitridae*. Closer examination of the type specimen of *thalia* revealed that the animal was still inside the shell. The answer was there all the time, if Tomlin, or myself, had had the inquisitiveness to drill a hole in the type. Too much caution (merely looking at the outside of the shell) does not increase knowledge! The radula of this animal confirmed the identification of the newly acquired specimens.

The type of *euphrosyne*, the genotype of *Charitodoron*, however, is definitely an empty shell; and none of the other specimens in the South African Museum contains an animal. But the very close conchological resemblance of *thalia* and *pasithea* (and *agulhasensis*) to *euphrosyne* leaves little doubt that the radula of the latter will not prove to be different.

Charitodoron may therefore be accepted as a Mitrid genus, but instead of making it a synonym of the subgenus *Dibaphus*, from the genotype of which (*edentula*) it differs considerably in shape, I would suggest retaining it as a subgenus of *Mitra*, containing *euphrosyne* Tomlin, *agulhasensis* Thiele (= *aglaia* Tomlin), *thalia* Tomlin, *pasithea* Tomlin and *bathybius* Barnard. The last species has stronger axial sculpture than any of the other species.

Variation in the spiral sculpture in the new material indicates the possibility that *pasithea*, with definite spiral sulci, may be only a form of *thalia*, with spiral impressed lines. The absence of an operculum (cf. *bathybius*, loc. cit., p. 51) is confirmed. The animal is black or very dark brown, with short tentacles and no eyes. Radula with sixty to sixty-five rows, as in *bathybius*, but the central plate has six cusps (i.e. no median cusp). The largest shell of *thalia* is 34·5 × 13·5 mm., aperture long, 15 mm. Two shells from the same haul measure 28·5 × 11 mm. and 25 × 11 mm.

PLANORBIS (*ANISUS*) *VORTICULUS* TROSCHEL IN THE THAMES VALLEY

By M. P. Kerney and F. May

(*Read before the Society*, 17 *October* 1959)

On 12 September 1959 one of the writers (F. M.) paid a chance visit to Shortwood Pond, about three-quarters of a mile E.N.E. of Staines, Middlesex (Grid reference TQ/049719). As a result of the long, hot summer of this year, the driest ever to be recorded in Britain, the water-level had sunk by between 2 and 3 feet, exposing areas covered by mats of damp aquatic vegetation. Some of this was collected and later shaken out in water; it proved to contain large numbers of both living and dead Mollusca, among which were many examples of the very local British snail *Planorbis* (*Anisus*) *vorticulus* Troschel, known in this country only from marsh drains and a castle moat in Sussex and Norfolk, and possibly also in East Suffolk (Stelfox, 1912; Ellis, 1926, p. 122; 1928; 1931; 1932; 1941; 1951; Mayfield, 1909). A joint visit was made on 19 September and a fortnight later the Conchological Society held a field meeting to the spot.

Shortwood Pond covers about 4½ acres. Its surroundings are low-lying and subject to occasional floods, such as occurred in February 1947. The nature of this pond, or rather lake, with its steep, bluff-like sides and irregular bottom, points to its being artificial, or at any rate much altered by human interference. It has existed, however, at least since 1865, being shown on the Ordnance Survey first edition six-inch map of that year in almost exactly its present form. On the other hand, it is not shown on the O.S. first edition one-inch map of 1822, which marks considerably smaller bodies of water. Everything suggests that it is an old flooded gravel pit, dug probably during the earlier part of the last century, perhaps to obtain metalling for the adjoining main London–Staines turnpike road (A. 30).

Planorbis vorticulus was found only near the northern, more shallow end of the lake, especially in places where grow masses of the aquatic moss *Fontinalis antipyretica* L. interspersed with smaller patches of *Characeae* (both kindly named by Mr. C. P. Castell). Where present, *P. vorticulus* was abundant, although a high proportion of the individuals were juvenile. The largest shell seen measured 3·8 mm. in breadth. Common associates on the vegetation were *Bithynia tentaculata* (L.), *B. leachi* (Sheppard), *Lymnaea stagnalis* (L.), *Planorbis carinatus* Müller var. *dubia* Hartmann, *P. vortex* (L.), *P. albus* Müller and *Segmentina complanata* (L.). The bottom in this part is generally a dark grey gravelly silt; on this live *Valvata cristata* Müller, *Sphaerium corneum* (L.), *Pisidium milium* Held, *P. subtruncatum* Malm and *P. henslowanum* (Sheppard). Other species collected were *Viviparus contectus* (Millet), *Valvata piscinalis* (Müller), *Lymnaea peregra* (Müller), *Physa fontinalis* (L.), *Planorbarius corneus* (L.), *Planorbis crista* (L.), *Acroloxus lacustris* (L.), *Unio pictorum* (L.) and *Anodonta cygnea* (L.).

At the south end of Shortwood Pond, but separated from it by a raised causeway, there is a marshy area into which drains a shallow *Lemna*-covered ditch. *Potamopyrgus jenkinsi* (Smith) is here present in enormous abundance, associated, in much smaller numbers, with *Bithynia tentaculata*, *Lymnaea peregra*, *Planorbis carinatus* var. *dubia*, *P. vortex*, *P. albus*, *P. contortus* (L.), *Sphaerium lacustre* (Müller) and *Pisidium subtruncatum*.

Some 700 yards to the E.S.E. is another small lake of about 2 acres, rather willow-shaded, lying alongside the railway and probably made when the line was constructed in 1848 (TQ/055718). On the occasion of the Society's visit on 3 October the following species were collected near the western end of the lake : *Valvata cristata*, *Bithynia tentaculata*, *B. leachi*, *Lymnaea peregra*, *Planorbarius corneus*, *Planorbis vortex*, *P. albus*, *P. crista*, *Segmentina complanata*, *Sphaerium corneum* and *Pisidium subtruncatum*. *Planorbis vorticulus* was not found.

Planorbis vorticulus occurs primarily in central and south-east Europe, extending no further north than Denmark, and reaching England at the extreme western end of its range. Here it is known to live only in clean, slowly-moving or still waters, probably in all cases hard (though this needs checking), but not in small closed ponds nor in fast-running streams or rivers. Records for Holland and northern Germany suggest a similar mode of life. As might be expected, it is apparently absent from Post-glacial deposits formed in the open Thames at and near Penton Hook, 2 miles S.S.W. of Shortwood Pond (Howard, 1952) and from similar deposits west of Staines (Kennard and Woodward, 1906). *P. vorticulus* has, however, a long geological history in south-east England, in the main consistent with its present-day ecological requirements. It first appears in the Cromerian of Norfolk (early Pleistocene) and is known sporadically from the later interglacials, and from Post-glacial deposits in Suffolk and Cambridgeshire.

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THE TWENTY-FIFTH ANNIVERSARY OF THE NETHERLANDS MALACOLOGICAL SOCIETY, 1959

Report by S. P. DANCE, the Conchological Society's delegate.

To commemorate its twenty-fifth anniversary year the Netherlands Malacological Society organized a celebration from 27 to 30 June 1959. The celebration was international in character and attracted malacologists and palaeontologists from many European countries, including Switzerland, France, Germany, Denmark, England and Italy. A large Dutch contingent reflected the keen interest now being shown in the study of molluscs in the Netherlands. Indoor meetings were held in Amsterdam and Leiden.

After the inaugural luncheon and festive dinner, Professor G. Thorson, of Elsinor Marine Biological Station, Denmark, gave a fascinating illustrated lecture on " Breeding habits and larval development in marine prosobranchs ". A field meeting to study the freshwater mollusc fauna of the Kortenhoef pools near Hilversum was arranged for Sunday, 28 June. Apart from a feast of beautiful scenery the day afforded some exceptional collecting, the most notable capture being the rare *Planorbis riparius* Westerlund, a very local species that may yet be recognized in the British Isles. Several papers were read and discussed the next day at the Rijksmuseum van Natuurlijke Historie, Leiden. Most of the afternoon was devoted to a discussion on the difficulties experienced by custodians of public Mollusca collections and on the possibilities of a closer co-operation between these custodians. The discussion was opened by Dr. L. Forcart (Basle) (see *Arch. Moll.* 88, 191–4).

He said that the exhibition of specimens was determined, very largely, by the nature of the institution. All institutions are short staffed and, as a result, much unworked material has accumulated. Catalogues of such materials could be prepared and deposited together in an institution where they would be accessible to specialists. It is manifestly impossible to publish lists of type specimens and other valuable materials held by the larger institutions, but it should be possible to centralize information on the collections housed in institutions and elsewhere. He suggested a more uniform style and treatment of subject matter for faunistic publications, and proposed that international standards be established for shell measurements and a uniform Latin nomenclature be used to indicate parts of the shell and animal. An important task for European malacologists would be a work on Palaearctic land molluscs similar to Pilsbry's *Land Mollusca of North America.* If groups were revised as the materials came to hand, the several revisions could then be united into a single work. This task implies considerable nomenclatorial research. Molluscan nomenclature is in a chaotic state in many ways, and takes up more and more of the specialist's time. As far as European malacology is concerned, such research could best be undertaken in conjunction with taxonomic revisions of molluscan groups. A committee could be set up to examine all problems of molluscan nomenclature before approaching the International Commission. Unsatisfactory decisions could be avoided in this way. An outstanding problem in most West European institutions is the need for new curators. If an international exchange of younger assistants and curators could be arranged, they could see how problems are tackled in other institutions and would be able to make friends.

Dr. Forcart ended his speech by suggesting that international co-operation could be achieved through a union of the several national malacological societies with museums and other institutions where molluscs are studied. International meetings of malacologists could be held in rotation and committees could be nominated to work out those problems that must be settled internationally. A long discussion followed. It appeared that the company present were very interested in the idea of a European Malacological Union and especially favoured periodic international meetings of malacologists. To explore the possibilities of such a union a committee was appointed consisting of Dr. C. O. van Regteren Altena (Leiden), Mr. S. P. Dance (London), Professor P. H. Fischer (Paris), Dr. L. Forcart (Basle) and Dr. A. Zilch (Frankfurt-am-Main). Mr. Dance promised to try to arrange the first meeting of European malacologists in Great Britain in 1962 or 1963. This could be the constitutional meeting of the European Malacological Union.

A convivial dinner ended a most eventful day and the official part of the celebration ended on a cordial note.

The anniversary was marked also by the publication of a Supplement to Vol. 23 of the Society's journal *Basteria.* This is devoted entirely to the Dutch molluscan fauna considered from an ecological point of view and is undoubtedly a major contribution to European malacology. The Netherlands Malacological Society has travelled a long way in twenty-five years.

***Monacha cantiana* (Montagu) in Fife.**—*Monacha cantiana* has been recorded as a Fife adventive from Charlestown, near Rosyth, on the Firth of Forth (R. Dunlop, *Scot. Nat.* for 1920, 169) where it occurred " on ballast heaps and blocks of limestone ", and it still existed there in small numbers in September 1934 (*fide* A. R. Waterston *in litt.* 1956). On 18 August 1956 the species was found living on a steep grassy bank at Roome Bay, Crail, also in Fife. The exact locality was the slope down to the sea from Roome Bay Crescent, and the snails appeared to be fairly common, associated with numerous *Helix aspersa* Müller, *H. nemoralis* L., *Hygromia striolata* (C. Pfeiffer) and *Helicella caperata* (Montagu). The specimens of *M. cantiana* were exhibited at a Conchological Society meeting (see *J. Conch.* **24**, 219, 1957). Mr. Waterston has suggested that *M. cantiana* was introduced with ballast when Crail was a flourishing port trafficking largely with Holland and western Europe. However it arrived, the species appears to be well established at Crail.

N. F. McMillan.

(*Read before the Society*, 16 *January* 1960)

Hugh Watson

[To face page 407

HUGH WATSON

SINCE I visited Hugh Watson a good many times and had a voluminous and continuous correspondence with him for about fifteen years, I feel that I probably knew him as well as anyone and some personal reminiscences may be of interest. I would also like to show that it is wrong to think of him as an austere, severely critical and wellnigh infallible man. He was as capable of putting 1955 at the top of a letter which was written in early 1956 as are most of us. This may help to reassure those who, like myself, have thought of giving up any attempt to do scientific work after having received a particularly devastating quire of criticism about some work one had sent him.

Owing to his retiring habits Hugh Watson's name was known to a relatively small circle of zoologists, but it is undoubtedly true to say that he was one of the most accurate and careful scientists of his generation and that he would under different circumstances have gained the highest honours obtainable in the scientific world ; he was not interested, however, in such mundane considerations.

I first corresponded with Hugh Watson in 1945 concerning the interesting fact that certain species became much rarer at the eastern end of the Chiltern Hills, e.g. *Abida secale* and *Pomatias elegans*. We rapidly discovered a common interest in the genus *Carychium* and after my first visit to his house in February 1946 I withdrew from publication a preliminary article on the subject and we agreed to co-operate to produce something more elaborate. This first criticism of a paper which I had from him rather discouraged me, although on looking back on it I realize that it was the most complimentary I ever received from him and that in fact I would have been delighted if I had known just how devastating he could be. Even when I ventured to admire certain papers which had recently appeared and which seemed to me to be excellent, he would proceed with unrelenting tenacity to show me just how bad they really were. The short joint paper on *Carychium* was not to be finished for another six years and I had a perfect demonstration of the amount of work which went into a paper which bore Hugh Watson's name. We examined thousands of specimens of recent and fossil *Carychium* from throughout the range of the species we were interested in ; I took scores of photographs trying to produce something which was satisfactory, measured hundreds of shells and spent hours at a time trying to mount and flatten out the incredibly minute radulae.

My first visit to his very pleasant house will always remain a clear memory—the desk piled high with years of correspondence, postcards bearing dates in the early 1920s in racks above the mantelpiece, his apologies for the weak tea he drank, and his own fine but gentle face and silky silver hair still with a good deal of golden-chestnut about it. I visited him on many occasions during the past fifteen years, every time I came home on leave from Africa, but my last intended visit was not to be ; he died a few days before I arrived in England. Instead I spent a most sad afternoon hunting amongst his effects for the large quantity of material which I had sent him from Africa during the past ten years and also for that of some of his other correspondents ; he had scarcely been able even to glance at all this material. The volume of correspondence he had had to deal with was evident from the two large piles which had accumulated since his death ; letters bearing postmarks from an incredible number of places ; several books he had ordered arrived either just before or after he died, including a superb copy of Férussac which he had only had time to glance at.

Although every paper, drawing and letter which left Hugh Watson was meticulously prepared and faultless, curiously enough he was very far from orderly in the way he stored his collections, correspondence and even his books. He was one of those people who could remember the position of everything and orderly storage was not necessary. Many people with memories above the average find that it saves a good deal of time if at least some sections of their affairs are left purely to memory. Correspondence and unworked material were always left in the original wrappings, and voluminous notes about his replies were written in pencil on blank parts of the letters or wrappers, or on old share dividend announcements. This correspondence was heaped in piles of hundreds of letters on his desk, which resembled a mountain range and seemed to change but little in configuration in the time between one's visits, even when these were separated by as much as three years. From a conchological point of view his collection was rather poor ; he had some glass cabinets with various shells on display, and also a vast amount of material which had been sent to him for study and which he had often been allowed to retain (although he borrowed large quantities of material also), mainly housed in cupboards ; often shells were balanced rather precariously on the corks of the tubes containing the dissected animals to which the shells belonged. Many of his ornamental shells lacked data labels and since he was not primarily interested in collecting shells he kept no catalogue. His first and foremost interest was the elucidation of the affinities and relationships of the animals themselves. Some people will perhaps be relieved to know that such a paragon was very human and even downright untidy in some respects !

His method of writing a paper was not to keep writing fresh drafts and continuously altering, but to keep all the threads in his head (save of course for certain data which one must note down) and then when he was satisfied that his arguments were complete and sound he would write the paper down in its entirety all at once. This probably explains why his papers are so clear and the uniform flow of thought and language which characterizes them ; not only are they masterpieces of accurate research but also of good plain English. He would not use a long word when a simple one would do. He liked to give all his references at the foot of the page, even if they took up over half the page. He did not like diagrams and always insisted that a figure must be absolutely true to nature to be of any value at all. I frequently had arguments with him over methods of mounting radulae. He always claimed that he could make out far more detail if a radula was unstained and mounted in glycerine jelly than if it was stained and mounted in a mountant of more suitable optical properties. Any arguments to show that glycerine jelly showed things up because of great differences in refractive index, resulting in distortion, fell on stony ground.

He had absolutely no time for shoddy work in any sphere and most people took what he had to say to heart, though sometimes they had a feeling that he had been a bit too exacting over something which did not really matter. He would not admit, what is well known to all mathematicians, that in some cases an approximation is all that is justified. This somewhat high and mighty attitude even prompted one famous conchologist (now also dead) to call him the " Hitler of the snail world ", which is completely unjustified. Nature is not herself so accurate ; variation in the field is so considerable that to harp on small details sometimes leads one into being a splitter and Watson had tendencies in that direction. I remember once having a long argument with him when he suggested that a certain fat *Carychium* from a Welsh locality was a distinct species ; one of the few arguments I ever had with him which resulted in him admitting that he was wrong. Occasionally he was what can only be described as pig-headed over this desire for more than usual precision. Once when taking a series of photographs for him he complained that some were not quite the correct size even though I had carried out the work using one fixed magnification and measured it with a micrometer and tried to arrange the shells themselves in the same position ; I was naturally a little annoyed when I found that he had been measuring the prints by eye with an ordinary child's ruler. A photographer in Cambridge who was entrusted with the enlarging of these particular photographs was nearly driven to distraction and in the end had to explain that such accuracy as Watson desired was not inherent in the materials themselves and wholly beyond his ability, owing to the expansion and subsequent shrinkage of the sensitized fibres while passing through the various solutions.

Watson was the final court of appeal when one had a mollusc problem. Hundreds of workers all over the world were continuously asking him for his opinions. He was incredibly conscientious about his correspondence and his answers were often quite long papers almost in a state fit for publication. He would spend weeks answering one difficult query and exhaust it to such a degree that it is little wonder that he had little time left for his own researches ; he also complained that financial and domestic problems took up much of his time. If he had ignored his correspondence, as some of his fellow workers do, he would have got through a great deal more than he did. Another feature about his correspondence that will always be remembered is the number of words he could get on to a small piece of paper. He may well hold the record for the number which can be compressed into an air letter form.

I sometimes got the impression that he tended to foster the idea that he was in chronic ill health and that if he had not been such a willing prisoner in his own home he might have grown stronger. I cannot recollect him having mentioned leaving his house during all the time that I knew him ; even his dentist used to attend at his house. Most letters I received from him contained some passage or other about his poor health and his " vile body " as he always called it. Even when one had visited him for a few hours in the afternoon he often complained that the excitement had put up his temperature and forced him to stay in bed for a couple of days; one always tried to be as quiet and gentle in his presence as possible. There is no doubt that he was delighted to have visitors, but always by careful appointment, and one would sometimes get a last-minute telegram warning one not to come because he was feeling worse. I would have visited him a good deal more often if I had lived in England and regret very much not being home during his last illness when perhaps some help would have been appreciated. It is sad to reflect that practically no one went to the funeral of a man known to hundreds of workers throughout the world.

I have been tempted to end these reminiscences with a quotation from one of his letters to me, to give comfort to those of us who are more fallible. Where he culled it from I have not found out but it was in inverted commas :—

" If all the good people were clever
And all clever people were good,
The world would be nicer than ever
We thought it possibly could.
But somehow 'tis seldom or never
The two hit it off as they should."

The " never " is not needed in the fifth line because Hugh Watson was proof indeed that goodness and cleverness could be found together in one man, each at its highest level.

Addendum.—My correspondence with Hugh Watson, comprising all the letters he wrote to me and a proportion of those that I wrote to him, are in my hands, since they contain much valuable information of use to a student of African Mollusca. It will eventually be presented to the Department of Zoology in Cambridge, to which he bequeathed his collections and library.

B. VERDCOURT.

***Agriolimax laevis andicolus* (Orbigny) in Nairobi, Kenya.**—During February and March 1957 Mr. J. G. Williams, Ornithologist at the Coryndon Museum, Nairobi, brought to me numbers of small slugs for identification which he had found in his garden. Further observations showed that the slug (since all the specimens were clearly of one species) is a regular inhabitant of this particular garden. The late Hugh Watson examined specimens which I submitted to him and he was certain that the slugs were *A. laevis* and probably belonged to the sub-species mentioned, i.e. *Deroceras laeve gracile* Rafinesque of some writers. The animals measure about 30 × 3 mm. outstretched; they are brown with a slight purplish tinge, save for the pale grey tentacles and pale sole; the mantle is wrinkled. About equal proportions of those dissected proved to be euphallic or to have a vestigial penis. This is the only introduced slug which has come to my notice in East Africa.

B. VERDCOURT.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND

774th Meeting, held at the British Museum (Natural History), 17 October 1959

Mr. A. E. Ellis, vice-president, in the chair.

Member Deceased

The chairman reported the death, on 11 August, of Mr. B. O. Wymer.

Member Elected

A. G. T. Evans, Kingsley, Central Wall Road, Canvey Island, Essex.

Communications

" *Planorbis vorticulus* Troschel in the Thames valley," by M. P. Kerney and F. May.

" *Hygromia hispida* (L.) on Hoy, Orkney," by Mrs. N. F. McMillan.

" *Hygromia hispida* (L.) at Stromness, Orkney," by W. Groundwater.

" *Agriolimax laevis* cf. *andicolus* (Orbigny) in Nairobi, Kenya," by B. Verdcourt.

" Records of Veronicellidae from East Africa," by B. Verdcourt.

" The systematic position of *Pleurotomaria africana* Tomlin," by S. P. Dance.

Exhibits

Special exhibits : *Pleurotomaria, Dreissena.*

Mr. C. P. Castell : *Dreissena* and fossil *Pleurotomaria*, from the collections of the British Museum.

Mr. F. H. Cozens : *Travels through various provinces of the kingdom of Naples in* 1789, by Charles Ulysses, translated by Anthony Aufrere, 1795, with an appendix of seventy-eight pages consisting of a catalogue of shells.

Mr. S. P. Dance : examples of all the recent species of *Pleurotomaria*, from the collections of the British Museum ; *Vasconiella jeffreysiana* Fischer collected at Hendaye, France, by B. S. Kisch (the second known specimen with both valves still attached).

Mr. C. A. Raffray : shells from South Orkneys and Grahamland, collected by the Royal Research Ship *Shackleton.*

Dr. H. E. Quick : *Milax budapestensis*, collected by A. W. Stelfox in his garden at Newcastle, Co. Down.

Mr. L. W. Stratton : land snails from Florida.

775th Meeting, held at the British Museum (Natural History), 21 November 1959

Mr. A. E. Ellis, vice-president, in the chair.

Members Elected

Herbert Ant, Hamm (Westfalen), Wielandstrasse 17, Germany.

Roger Fresco-Corbu, B.Sc., 142 Oakleigh Park Drive, Leigh-on-Sea, Essex.

David Heppell, 49 Bassett Road, North Kensington, London, W. 10.

Miss Jill Shirley Kendrick, Herm Island, via Guernsey, Channel Islands.

Dr. José B. Stuardo, Estación Biologia Marina, Casilla 13 D, Viña del Mar, Chile.

Philip Terence Wimbleton, 13 Copsey Grove, Farlington, Portsmouth, Hampshire.

Fraulein Hildegard Zeissler, Staatliches Museum für Tierkunde, Dresden A. 1 (Saxony), Deutsche Demokratische Republik.

Communications

" Further Scottish records of *Potamopyrgus jenkinsi* (Smith)," by D. K. Kevan.

" The genus *Charitodoron* Tomlin, 1932," by K. H. Barnard.

Exhibits

Special exhibits : *Patella*, *Hygromia*. Specimens of these genera were exhibited by Mr. C. P. Castell (from the collections of the British Museum), Dr. H. E. Quick, Mr. R. P. Scase, Mr. L. W. Stratton and Mr. F. R. Woodward.

Mr. T. E. Crowley : marine shells from the British Isles and from the north-west coast of North America.

Mr. S. P. Dance : Lovell Reeve's Monograph of *Patella* (*Conch. Icon.*).

Dr. L. Lloyd-Evans : *Hygromia subvirescens* (Bellamy) from Pembrokeshire.

Dr. H. E. Quick : *Limax* (*Lehmannia*) *poirieri* Mabille from Reading, Berkshire.

776th Meeting, held at the British Museum (Natural History), 12 December 1959

The President, the Rev. H. E. J. Biggs, in the chair.

Communications

" A preliminary list of the marine Mollusca of Ras Tanura, Persian Gulf," by H. E. J. Biggs and Mrs. Leona L. Grantier.

Mrs. N. F. McMillan presented supplementary observations to her paper read at the 774th Meeting.

Exhibits

Special exhibit : Molluscan monstrosities. Mr. C. P. Castell exhibited examples from the Kennard collection and Mr. S. P. Dance gave an explanatory talk on the subject.

The President : specimens to illustrate his paper.

Mr. M. Goodchild : Mollusca collected on the occasion of the Society's field meeting at Sheep Leas, West Horsley, Surrey, 21 June 1959.

Mr. R. P. Scase : species of *Cymbiolacca* Iredale ; *Voluta canaliculata* McCoy from Lady Musgrave Island, Bunker Group.

777th Meeting, held at the British Museum (Natural History), 16 January 1960

The President, the Rev. H. E. J. Biggs, in the chair.

Members Elected

Mrs. E. M. Crowley, Clonard Cottage, Rowlands Avenue, Hatch End, Middlesex.

E. R. Denyer, 101 Edenfield Gardens, Worcester Park, Surrey.

G. Lewis, 49 Rances Lane, Wokingham, Berkshire.

Dr. J. E. Morton, Department of Zoology, Queen Mary College, Mile End Road, London, E. 1.

Mrs. M. Saul, c/o Police H.Q., Jesselton, North Borneo.

Mrs. S. M. Turk, F.Z.S., Shang-ri-la, Reskadinnick, Camborne, Cornwall.

Communications

" On the distribution and synonymy of *Strophocheilus* (*Megalobulimus*) *lichtensteini* (Albers)," by T. Pain.

" *Potamopyrgus jenkinsi* (Smith) in Orkney " ; " *Monacha cantiana* (Montagu) in Fife " ; " Non-marine Mollusca in north-east Scotland, with special reference to *Helix hortensis* Müller," by Mrs. N. F. McMillan.

" The rediscovery of *Guivillea* Watson," by K. H. Barnard.

Exhibits

Special exhibits : Pectinidae and monstrosities. Examples were shown by the President, Mr. C. P. Castell (from the British Museum collections), Mr. T. E. Crowley, Mr. D. Heppell, Dr. M. P. Kerney, Mr. T. Pain, Mr. J. F. Peake, Mr. L. W. Stratton and Mr. F. R. Woodward.

Mr. T. E. Crowley: *Limicolariopsis sjostedti* d'Ailly, paratype with eggs (in spirit).

Mr. T. Pain : *Systematics and Zoogeography of the land and fresh-water Mollusca of the New Hebrides*, by Alan Solem (*Fieldiana* : Zoology, **43**, Chicago Natural History Museum, 1959).

Mr. J. F. Peake : *Edentellina corallensis* and *Thecalia concamerata.*

Mr. R. P. Scase : *Voluta studeri* Martens, off Moreton Island (120 fathoms), Queensland.

778th (Annual) Meeting, held at the British Museum (Natural History), 20 February 1960

The President, the Rev. H. E. J. Biggs, in the chair.

Members Elected

Derek S. Davis, 56 Altmore Avenue, East Ham, London, E. 6.

Alfred William Jones, 15 Suffolk Road, London, S.E. 25.

Ralph John Robson, 285 Bromford Road, Ward End, Birmingham 34.

Mrs. D. M. Tucker, Old Walls, Salcombe, Devon.

Election of Scrutineers

Mr. P. Coxhead and Mr. J. F. Peake were elected scrutineers.

Election of Auditors

Mr. S. P. Dance and Miss M. Maitland Howard were re-elected auditors.

Statement of Accounts

The Hon. Treasurer presented the audited accounts for 1959, which were adopted.

Annual Reports

The reports of the Council, the Recorders and the Curator were presented and adopted.

Votes of Thanks

Votes of thanks were approved to the Trustees of the British Museum (Natural History) for permitting the Society to hold meetings at the Museum ; to the Keeper of Zoology and to Mr. I. C. J. Galbraith for allowing members to use the molluscan library and collections, and to Mr. S. P. Dance for his voluntary attendance at the Museum on meeting days for the convenience of members wishing to consult the library and collections ; and to the Officers and Council for their work on behalf of the Society.

Presidential Address

The President delivered an address on "Mollusca from Prehistoric Jericho".

Election of Officers and Council

The Officers and Council were elected as shown on page 377.

Exhibits

The President : specimens to illustrate his address.

Mr. S. P. Dance : A. Seba, *Thesaurus naturalium*, vol. 3, 1758 ; R. Tucker Abbott, *Indo-Pacific Mollusca*, vol. 1, Acad. Nat. Sci. Philadelphia, 1959.

Mr. S. P. Dance and Mr. L. W. Stratton : Caddis cases (Trichoptera) simulating *Dentalium* and helicoid shells.

Mr. L. W. Stratton : North American Unionacea ; A. H. Clarke and C. O. Berg, *The freshwater Mussels of central New York, with an illustrated key to the species of north east North America*, Cornell Univ. Agric. Exper. Station, Mem. 367, 1959.

Report of the Council

Twenty-two members were elected during the year. The names of eighteen members have been removed from the list through resignations and non-payment of subscriptions, and the Society has lost one member by death, Mr. B. O. Wymer. This results in a gain of three, making a total membership of 186, including six honorary members.

Seven ordinary meetings, an extraordinary and an annual general meeting have been held at the British Museum (Natural History). Four field meetings were held : Horsley, Surrey ; Watford, Herts ; Staines, Middlesex ; Farthing Downs, Surrey.

Two numbers of *The Journal of Conchology* were published, namely vol. 24, No. 9, 25 February, and No. 10, 10 December 1959.

The Society was represented by Mr. S. P. Dance at the twenty-fifth anniversary celebration of the Netherlands Malacological Society in June 1959. It was suggested that a conference of European malacologists should be held to consider the foundation of a European Malacological Union. The Conchological Society and the Malacological Society of London have agreed to act as joint hosts of a conference to be held in London in 1962. A grant of £10 has been made by each Society towards the preliminary expenses.

Curator's Report

The collection has been moved from the room in which it was first housed to another part of the building, so that the rearrangement of the collection was retarded. Twelve additions have been made during the year. On looking through the vice-comital lists on which the specimens are tabulated, it was noted that about three-quarters of the lists are either blank or have only one or two recordings made on them. An appeal is made to members who have duplicates or unwanted specimens to send them in, labelled with locality and date, for incorporation in the voucher collection.

F. H. COZENS.

Recorder's Report : non-marine Mollusca

Since the publication of the last report (vol. 24, p. 365) just over a dozen new records have been authenticated. The most noteworthy of these is *Planorbis vorticulus* Troschel from Middlesex ; hitherto this very local species had been recorded only from Sussex and East Norfolk.

Middlesex (21) : *Planorbis vorticulus* (see page 403).

Berks (22) : *Acanthinula lamellata*, dry ditch on the Kennet side, Theale lock, near Reading, 1902, W. Holland. Entered in the last edition of the Census (vol. 23, p. 207) as unconfirmed, but Mr. S. P. Dance has shown me the specimen, now in the British Museum (Natural History), and there seems to be no reason for not accepting it as a county record.

Monmouth (35) : *Anodonta minima*, R. Wye, Monmouth, F. R. Woodward. [The interpretation of *A. minima* Millet put forward by Kennard, Salisbury and Woodward, 1925 (*Proc. Malac. Soc.* **16**, 271) has been called in question (Brander, 1956, *Arkiv för Zoologi* (2), **9**, 175). This species is generally known as *A.* (*Pseudanodonta*) *complanata* Rossmässler on the Continent.]

Cardigan (46) : *Lauria anglica*, Coed Rheidal, T. Huxley.

Caernarvon (49) : *Acanthinula lamellata*, Coed Dolgarrog, T. Huxley.

Wigtown (74) : *Potamopyrgus jenkinsi*, *Planorbis crista*, Whitefield Loch ; *Sphaerium lacustre*, Water of Luce and Kirkmaiden, T. Warwick.

Selkirk (79) : *Sphaerium lacustre*, *Pisidium amnicum*, *P. subtruncatum*, Ashkirk, D. K. Kevan.

Roxburgh (80) : *Pisidium casertanum*, *P. personatum*, Alemoor Loch, D. K. Kevan.

Aberdeen North (93) : *Pisidium nitidum*, Loch of Strathbeg, Mrs. N. F. McMillan.

Down (115) : *Milax budapestensis*, Newcastle, A. W. Stelfox.

A. E. E.

Recorder's Report : marine Mollusca

Three minute shell-less gastropods of the suborder Acochlidiacea were added to the British list in 1959, namely *Microhedyle lactea* Hertling, *Hedylopsis suecica* Odhner and *Philinoglossa helgolandica* Hertling, all from shelly gravel in 7 fathoms near the entrance to Plymouth Sound (*Nature*, 13 June 1959, p. 1695).

Mactra glauca Born is stated by Marshall, 1897 (*J. Conch.* 8, 386) to be common on Jersey, very rare on Herm and doubtfully recorded from Guernsey. Mr. R. W. Greenish took a fine living example at extreme low water spring tide at Belvoir Bay, Herm, 24 August 1957. In Liverpool Museums there are three specimens taken alive from Herm, all undated (Mason and Winckworth collections). There are also two good specimens from Guernsey (Standen-Jackson collection), a number from Jersey, including two white forms, and one from Hayle, Cornwall. Gardiner's Census map cites " Guernsey, etc., Winckworth, Tomlin ".

Limapontia capitata (Müller), an addition to Area 1b, was taken by the Recorder in September 1959 on the island of Hoy, Orkney. Several specimens were found on *Cladophora* in a tidal rock-pool at Braebuster.

NORA MCMILLAN.

CORRECTION : Vol. 24, No. 9, page 329, 14th line from foot, for *Viviparus* read *Helix aspersa*.

REVIEWS

British Slugs (Pulmonata ; Testacellidae, Arionidae, Limacidae). H. E. QUICK. pp. 103–226, 2 half-tone plates, 19 text-figures, 23 maps. *Bulletin of the British Museum (Natural History), Zoology*, vol. 6, No. 3. London, 1960. £2 5*s*.

FOR some years it has been known that Dr. Quick was preparing a monograph on British slugs to be published by the Natural History Museum, and it has now appeared. The present work is an amplification of the same author's Synopsis issued in 1949 by the Linnean Society, and the plates are the same. The information is given for each species under the following headings (any of which may be omitted) : notes, first British record, diagnostic features, external appearance, external variation, shell, anatomy (including jaw and radula), spermatophore, mating, development, behaviour, ecology, distribution and fossil record. The anatomy, particularly features of diagnostic value, is thoroughly described and figured. The distribution maps are copied from the Society's Census maps.

One species is added to the British list, namely a *Milax* tentatively referred to *insularis* (Lessona & Pollonera), collected near Bexhill, Sussex. The name *Arion fasciatus* (Nilsson) replaces *A. circumscriptus* Johnston. *Lehmannia* Heynemann is raised to generic status, following some Continental authors, though the justification for this is not apparent.

The half-tone figures are not all very helpful as a guide to identification. One would have thought the Museum could have afforded colour plates, which are really necessary for slugs, especially in view of the exorbitant price. Is this *Bulletin* worth 42*s*. 6*d*. more than the Linnean Society's Synopsis ? The answer is in the negative, which is most regrettable, as the price is bound to restrict the sale of this excellent monograph severely.

British Caenozoic Fossils (Tertiary and Quaternary). pp. vi, 85, 45 plates. British Museum (Natural History), London, 1959 [February, 1960]. 6*s*.

THIS is the first of a series of illustrated handbooks designed to help those without special knowledge to identify their fossil finds. It contains line drawings of over 350 common or conspicuous British Caenozoic fossils, accompanied by a note of the geological range of each and the locality from which the figured specimen was obtained. There are in addition a short general introduction, a list of the British Caenozoic strata and of their more important fossil localities, a short bibliography and an excellent index. The drawings are, with few exceptions, really first-class, and the whole is printed on good quality paper.

The fossils have been chosen with great care and their scientific names have been revised in accordance with the most recent authorities. Representatives of many phyla are included, but, of course, most of the illustrations are of Mollusca. This reviewer knows of no publication of similar scope since the celebrated Chart by Edwards, Etheridge and Lowry, published in 1866 and now, alas, almost unobtainable.

Members of the Conchological Society have played no small part in the production of the present volume. The late Arthur Wrigley prepared many of the drawings and the general compilation was in the hands of our President, Mr. C. P. Castell, who had several collaborators from among our members.

One small blemish detracts from an otherwise excellent publication. Many of the illustrations are magnified or reduced but there is no indication on the plate itself when this is the case. When a number of illustrations of differing magnifications are included on one plate, the result can be very misleading. In a publication of this kind, there is much in favour of an arrangement so that, as far as possible, all figures on the same plate are of the same scale and any not of that scale are indicated in some way.

Two additions might usefully be made to the bibliography : *Directory of British Fossiliferous Localities* (Palaeontographical Society) and *Iconographie . . . des Coquilles fossiles . . . de Paris* (M. Cossmann and G. Pissarro).

The Trustees of the British Museum are to be congratulated on their new enterprise, which supplies a real need. This first volume is unreservedly recommended as good value to anybody who has even the slightest interest in Tertiary fossils.

DENNIS CURRY.

GYRINA GIGANTEA (LAMARCK) IN NEW ZEALAND WATERS

By S. P. Dance, Department of Zoology, British Museum (Natural History)
and R. K. Dell, Dominion Museum, New Zealand

(*Read before the Society*, 19 *March* 1960)

The presence of *Gyrina gigantea* (Lamarck) in South African waters was noted by one of us recently (Dance, 1959). This was a considerable extension to the known range of a species hitherto reported only from the Mediterranean and north-eastern Atlantic. Its presence in numerous dredgings off Angola was also noted for the first time. A further remarkable extension may now be reported.

It had long been realised that the New Zealand species *Ranella multinodosa* Bucknill (1927) was closely allied to the Mediterranean *G. gigantea.* We have been able to compare specimens of the New Zealand shell with specimens of *G. gigantea* from the Mediterranean and north-eastern Atlantic, and with the large series taken off the mouth of the Tugela River, Natal, South Africa. Although the New Zealand specimens vary considerably in size, shape and ornament, they can all be matched in the South African series. Therefore, the New Zealand form must also be called *Gyrina gigantea.* There seems no doubt that *Ranella ostenfeldi* Iredale (1937), also from New Zealand, is a synonym.

In New Zealand waters the species is known from Whangaroa in the north to the Otago coast in the south at depths of 20 to 60 fathoms. Although it is local in occurrence, commercial trawlers sometimes take it in quantity. Nothing that could be referred to this species has yet been recorded from South Australian waters, although the larger elements of the shelf fauna have now been extensively collected.

References

Bucknill, C. E. R., 1927. Description of two new species of marine gastropod. *Trans. N.Z. Inst.* **58,** 311–312.

Dance, S. P., 1959. *Gyrina gigantea* (Lamarck), an unexpected addition to the South African marine fauna. *J. Conch.* **24,** 351–352, pl. 9.

Iredale, T., 1937. Notes on Neozelanic deepwater marine Mollusca. *Rec. Aust. Mus.* **20,** 103–107.

Hygromia subrufescens **(Miller) and *H. subvirescens* (Bellamy) living together.**—On 1 and 2 September 1958 these two species were found at Blackstone Point, South Devon, at the mouth of the River Dart, immediately behind the wooden hut used during the regatta for timing the races. Individuals of both species were thoroughly intermingled and mostly alive, lying on or just below the surface of the soil at the base of grass, thyme and heather (sea campion was absent). The snails were not abundant, careful search of an area 2 or 3 yards square for an hour on two occasions producing nine *H. subrufescens* and twenty-one *H. subvirescens.* It is a site where one would expect to find the latter but hardly the former.

H. E. Quick.

ACCOUNTS FOR THE YEAR ENDING 31 DECEMBER 1959.

Income and Expenditure Account.

Dr.

	£	s.	d.	£	s.	d.
To Annual Subscriptions—						
,, Paid in 1958	29	13	0			
,, Arrears	6	0	0			
,, Current	140	17	10	176	10	10
,, Sales, etc.				118	2	5
,, Donation				5	0	0
,, Dividends and Interest :—						
	26	14	10			
	18	4	11			
	14	0	0			
	14	0	0	72	19	9
,, Balance, being excess of Expenditure over Income carried to Balance Sheet . . .				21	14	7
				£394	7	7

Cr.

	£	s.	d.	£	s.	d.
By Publication and Distribution—						
Vol. 24, pt. 9 . . .	121	15	10			
Authors' reprints . .	10	3	9	131	19	7
Vol. 24, pt. 10 . .				184	15	0
,, Despatch of parts . . .				10	16	10
,, Printing and Stationery . .				8	6	3
,, Officers' Expenses . . .				13	4	2
,, Bank Charge					2	6
,, Prospectus and Nomination forms				23	11	0
,, Donations :—						
Zoological Society . .	2	0	0			
Council for Nature . .	1	0	0			
International Malacological Conference	10	0	0	13	0	0
,, 1958 payment made in 1959 but charged in the 1958 Account .				8	12	3
				£394	7	7

Research and Reserve Fund.

	£	s.	d.
To Amount of Fund, 1 January 1959 . .	466	1	2
	£466	1	2

	£	s.	d.
By Amount of Fund, 31 December 1959 . .	466	1	2
	£466	1	2

Life Membership Fund.

	£	s.	d.		£	s.	d.
To Amount of Fund, 1 January 1959	569	14	0	By transfer to Income and Expenditure Account	24	0	0
,, Dividends and Interest	24	0	0	,, Amount of Fund at 31 December 1959	569	14	0
	£593	14	0		£593	14	0

BALANCE SHEET

Liabilities.				£	s.	d.
Annual Subscriptions paid in advance				18	3	11
Life Membership Fund				569	14	0
Research and Reserve Fund				466	1	2
Capital Stock				800	0	0
Balance from Income and Expenditure Account—						
As on 1 January 1959	538	11	11			
Less excess expenditure, 1959	21	14	7	516	17	4
				£2,370	16	5

Assets.	£	s.	d.	£	s.	d.
4% Funding Loan (cost)	350	0	0			
2½% Defence Bonds (cost)	200	0	0			
3½% War Loan (cost)	40	0	0			
3½% Defence Bonds (cost)	800	0	0	1,390	0	0
Cash—						
At National Provincial Bank	210	2	3			
,, Post Office Savings Bank	765	14	2			
In hand, Secretary	5	0	0	980	16	5
				£2,370	16	5

NOTE.—Assets in addition to those set out in the above Balance Sheet are stocks of unsold publications and outstanding subscriptions.

Examined and found correct.
S. P. DANCE,
M. MAITLAND HOWARD } *Auditors.*
4 *February* 1960.

C. A. RAFFRAY.
Hon. Treasurer,
16 *January* 1960.

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CONTENTS.

PAGE

Pomacea (Ampullariidae) of the Amazon river system—T. PAIN 421

Columella edentula (Draparnaud) and *Vertigo antivertigo* (Draparnaud) in West Sussex—M. GOODCHILD 432

Early breeding of *Marpessa laminata* (Montagu)—L. W. STRATTON 432

Some variations in the Unionidae—L. W. STRATTON . . 433

Hygromia subvirescens (Bellamy) in Pembrokeshire—L. LLOYD-EVANS 437

New species of South African marine Gastropods—K. H. BARNARD 438

Review 442

"Grimwood's Island," its geographical position and its connection with Hugh Cuming—S. P. DANCE 443

Cypraea broderipi Sowerby, another remarkable addition to the South African marine fauna—S. P. DANCE 446

Potamopyrgus jenkinsi (Smith) in Orkney—N. F. MCMILLAN . 447

Obituary: H. H. Bloomer and L. A. W. C. Venmans . . 448

Proceedings: 19 March, 9 April, 21 May 1960 . . . 451

Index to Volume 24 453

PLATE 11

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JOURNAL OF CONCHOLOGY

Vol. 24. 16 DECEMBER 1960. No. 12.

POMACEA (AMPULLARIIDAE) OF THE AMAZON RIVER SYSTEM

By T. Pain.

(*Read before the Society*, 9 *April* 1960.)

Although some of the species of *Pomacea* inhabiting the River Amazon and its tributaries have been known to science for over a century, many having been described by Spix in 1827, records of exact localities for them have remained almost non-existent and we are indebted to Haas (1949–1952) for such as there are. The relationship of the numerous species described remains, however, in a state of hopeless confusion. It was customary for the early authors who dealt with the Mollusca of this vast river system to refer all to the " River Amazon ", without more definite locality, which, considering the immense area covered, is of little help to any future investigators. It is therefore the purpose of this paper to give exact localities where known, as well as to indicate as far as possible the range of the species concerned and to supplement the papers of Haas (1949–1952). For many of the fine species described by Reeve (1856) and others, we are indebted to the great Victorian explorer naturalists Bates, Wallace, Spruce and Yates, who were amongst the first to make known to European collectors the land and freshwater Mollusca of the Amazon region.

Information regarding Amazon *Pomacea* has been made available from a number of sources and the author is deeply indebted to the following for this and in many cases for specimens as well. Dr. F. Haas (Chicago Museum), Dr. J. C. Bequaert and Dr. W. J. Clench (Museum of Comparative Zoology, Harvard College), Sr. H. de Souza Lopez (Inst. Oswaldo Cruz, Rio de Janeiro), the late Dr. Lange de Morretes (Museu Paranaense, Curitaba, Brazil), Dr. W. Weyrauch (Lima, Peru), Dr. W. Blume (Goettingen, Germany) and Mr. S. C. Richardson (Melbourne, Australia).

Included also is material obtained by the author during a journey from Boã Vista on the River Branco to Manaos in 1938 and from Belem to Iquitos in 1939.

Fam. Ampullariidae

Genus *Pomacea* Perry, March, 1810 [= *Ampullarius* de Montfort, after March, 1810]. *Arcana Signature* G.5., pl. 12, 1810. Monotypic for *P. maculata* Perry [= *P. gigas* (Spix, 1827)].

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Group of *P. lineata* (Spix).

Pomacea (*Pomacea*) *lineata* (Spix).

Helix lineata Spix, 1827. *Testac. fluv. Brasil.* pl. 5, fig. 2.
Helix figulina Spix, 1827. *Ibid*, pl. 6, fig. 4.
Ampullaria lineata Philippi, 1851. *Mon. Ampullaria,* p. 11, pl. 2, figs. 5–6.
Ampullaria linnaei Reeve, 1856 (*non* Philippi). *Conc. Icon. Mon. Ampullaria,* figs. 115 a & b.
Ampullaria testudinea Reeve, 1856. *Ibid.*, fig. 114.
Ampullaria simplex Reeve, 1856. *Ibid.*, figs. 98 a & b.
Ampullaria physis Hupé, 1857. *Zool. Results Castelnais S. American Expedition,* **3,** Mollusca.
Ampullaria levior Sowerby, 1909. *Proc. Malac. Soc. Lond.*, **8,** 361, (fig. in text).
Ampullaria lineata Alderson, 1925. *Studies in Ampullaria,* 25, pl. 8, figs. 2, 3 & 4.
Ampullarius lineatus van Benthem Jutting, 1943. *Archiv. für Hydrobiologie,* **39,** 470.
Ampullarius lineatus Haas, 1952. *Fieldiana : Zoology,* **34,** no. 9, 110.

AMAZON REGION. Canals and ditches, Marayo Island (Pain, 1939). Rio Cuparé ; Cacaul Grande ; Lago Pucú, Rio Paraná do Taparasinho ; Fordlandia, Igarapé do Cacaul (Sioli). All in Pará State (Haas, 1952, 110).

RANGE. Brazil (Atlantic drainage), Pará, southwards to Rio de Janeiro. This common and variable species has been described under a number of names and several of those shown above as synonyms were recognized by Reeve (1856), Alderson (1925) and others as good species. However, after careful examination of specimens from many localities, I am of the opinion that none of them can be separated from typical *lineata* and all will be found to fall within the range of variation of that species.

P. levior (Sowerby) was retained as a separate species by Alderson (1925, 27) on the strength of its widely expanded aperture, rough texture and light colour. Shells possessing one or more of these features can, however, be found in any large series of typical *lineata.* Specimens up to 83 mm. in length have been recorded from Parahyba Province, Brazil, by Jutting (1943, 470). A small race, average length 30 mm., was taken on Marayo Island in a small stream amongst aquatic plants in December, 1939, by the author.

Pomacea (*Pomacea*) *haustrum* (Reeve).

Ampullaria haustrum Reeve, 1856. *Conch. Icon. Mon. Ampullaria,* fig. 23.
Ampullaria immersa Reeve, 1856. *Ibid.*, fig. 52.
Ampullaria haustrum Kobelt, 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.* n.F. 159, pl. 59, figs. 1–3.
Ampullaria haustrum Alderson, 1925. *Studies in Ampullaria,* 17–19, pl. 6, figs. 1–5.
Ampullarius insularum Haas, 1949. (*non* Orbigny, 1835). *Arch. Moll.*, **78,** 153.
Pomacea haustrum Souza Lopes, 1955. *Rev. Brasil Biol.*, **15** (2), 204 (text-figs. p. 206).

AMAZON REGION. Brazil : State of Pará ; Rio Tapajóz (Haas, as *P. gigas* Spix) ; Rio Maranon, Fonteboa and Tabatinga ; Santrem, Ilhé Grande Tapará and Lago Grande do Javary (Pain) ; Lago Baptista (Olalla). Peru : Rio Ucayali (Weyrauch) ; Cinco Copal, Agua Caliente, Pachitea River, Huanaco (Kummel, 1954). Bolivia : Amazon Region (Zischka).

RANGE. Brazil, throughout the Amazon Basin, eastward to Peru and

Bolivia; headwaters of the Amazon and Paraguay Rivers. Bahia Province (very doubtful record). Rio Grande do Sul.

This abundant species has frequently been confused with *P. maculata* Perry and *P. insularum* (Orbigny). It is, however, always smaller, with a more acute apex and a narrower umbilicus than is the case in *P. maculata*. The occurrence of *P. insularum*, which is the common *Pomacea* of the La Plata estuary, within the Amazon drainage, is most improbable. It is a rough and heavy shell, quite unlike either *haustrum* or *maculata*, which even in very large examples are always comparatively thin and fragile.

That *P. haustrum* and *P. immersa* are, as suggested by Alderson (1925, 18), one and the same species, seems to me to be the correct view of them, the more produced spire of the former, a by no means constant feature, being the main point of difference.

Pomacea (*Pomacea*) *amazonica* (Reeve)

Ampullaria amazonica Reeve, 1856. *Conch. Icon. Mon. Ampullaria*, fig. 55.
Ampullaria amazonica Kobelt, 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab*. n.F., 173, pl. 63, fig. 2.
Ampullaria amazonica Alderson, 1925. *Studies in Ampullaria*, 18.

Amazon Region. River Amazon (Reeve, without definite locality).

Range. Unknown.

This rare species does not seem to have been met with by any of the more recent collectors and the few specimens seen by the author were without definite locality.

Although resembling *P. haustrum* in general shape, *P. amazonica* differs in having a depressed, but not channelled, suture, the banding being much less definite and the pale greenish periostracum very thin.

I have been unable to recognize it amongst any recently collected Amazon material which I have seen.

Pomacea (*Pomacea*) *maculata* Perry.

Pomacea maculata Perry, 1810. *Arcana Signature*, G.5, pl. 12.
Helix gigas Spix, 1827. *Testac. Fluv. Brasil.* I, pl. 1, fig. 1.
Ampullaria gigas Reeve, 1856. *Conch. Icon. Mon. Ampullaria*, fig. 3.
Ampullaria crosseana Hidalgo, 1871. *J. Conchyl.*, **19**, 206.
Ampullaria gigas Kobelt, 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab*. n.F., 192, pl. 69.
Ampullaria gigas Alderson, 1925. *Studies in Ampullaria*, 22, pl. 7, fig. 3.
Ampullarius (*Ampullarius*) *gigas* Lange de Morretes, 1949. Ensaio de Catalogo dos Molluscos do Brazil. *Arquivos do Museu Paranaense, Curitaba*, **7**, Art. 1, 66.

Amazon Region. Brazil; River Amazon near Obidos (Pain). Peru: Iquitos, River Marañon in a deep lagoon amongst aquatic plants at Santa Terega; Lapuna, Rio Solimoes; Rio Napo at Corococha (Pain); Porto Velho, Rio Madeira, Territoria do Guapore (Alvarenga); Rio Solimoes (Reeve).

Range. Brazil and Peru, in the Amazon drainage. *P. maculata* is the largest freshwater gastropod known, specimens over 155 mm. in height and 135 mm. in greatest diameter being recorded. In spite of its great size it is a comparatively thin and fragile shell, which may in part account for its rarity in collections. The shell, having a wide aperture, is sometimes used by native rubber collectors for catching the latex from wild rubber trees, and I obtained fine specimens near Iquitos which had already been placed in position for this purpose. *P. maculata* lives in deep and still backwaters amongst thick aquatic vegetation and is not easy to obtain in good condition.

Pomacea (*Pomacea*) *nais* Pain.

Pomacea nais Pain, 1949. *Proc. Malac. Soc. Lond.*, **27**, 258, pl. 13, figs, 3 & 4.

AMAZON REGION. In a small clear stream near Obidos, on the south bank of the Amazon (type, Pain). Itacoitiara, Amazonas (Schultz).

RANGE. Amazon drainage.

This curiously elongated little species may prove to be a local race of *P. lineata* (Spix), which is, however, unknown at Obidos.

Pomacea (*Pomacea*) *hanleyana* (Alderson).

Ampullaria swainsoni Hanley, 1854–1858 (*non* Philippi). *Conch. Miscellany*, *Ampullaria*, pl. 1, fig. 1.
Ampullaria swainsoni Kobelt, 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.* n.F., 208, pl. 74, fig. 1 (*non* Philippi).
Ampullaria swainsoni Alderson, 1925. *Studies in Ampullaria*, 28, pl. 8, figs. 5 and 6.
Ampullaria hanleyana Alderson, 1926. *Proc. Malac. Soc. Lond.*, **18**, 42.
Pomacea hanleyana Pain, 1951. *J. Conch.*, **23**, 145.

AMAZON REGION. Brazil: Pará State, in the Quatipura River at Braganza (Rosado).

RANGE: Brazil, Pará State.

Hanley's name *swainsoni* was shown by Alderson (1926) to be preoccupied by Philippi; he renamed it *hanleyana* in consequence of this. The true locality long remained in doubt and the species was not discovered living until a hundred years after being first figured and described by Hanley (1854–1858). The oblong-ovate form and beautifully regular banding separate *P. hanleyana* from all other species found in the state of Pará.

Group of *P. scalaris* (Orbigny).

Pomacea (*Pomacea*) *aulanieri* (Hupé and Deville).

Ampullaria aulanieri Hupé and Deville, 1856. *Rev. Mag. Zool.*, 5, fig. 4.
Ampullaria limnaeiformis Reeve, 1856. *Conch. Icon. Mon. Ampullaria*, fig. 39.
Ampullaria coutamanoensis Preston, 1914. *Ann. Mag. Nat. Hist.*, Ser. 8, **13**, 627.
Ampullaria limnaeiformis Kobelt, 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.* n.F., 209, pl. 74, fig. 1.

AMAZON REGION. Peru: River Marañon, near Iquitos (I. Lapuna), in pools left by the inundation of the river (Pain).

RANGE: Peru, Amazon drainage.

This species resembles in shape the European *Lymnaea auricularia* (Linné), by reason of its widely expanded aperture and short spire. It is a rare and local species, of very distinctive appearance and easily recognizable.

Pomacea (*Pomacea*) *bridgesi bridgesi* (Reeve).

Ampullaria bridgesi Reeve, 1856. *Conch. Icon. Mon. Ampullaria*, figs. 50, 51.
Ampullaria bridgesi Kobelt, 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.* n.F., 183, pl. 66, figs. 1 & 2, pl. 78, figs. 1 & 2.

AMAZON REGION. Bolivia : Rio Grande, Reyes River at Beni (Bridges).

RANGE : Known only from the type locality.

The nominate race of *P. bridgesi* is a rare and local form, the only authentic specimens with which I am acquainted being the type set in the Cuming collection, now in the British Museum (Natural History), and some other examples apparently distributed by Cuming and probably paratypes. Of the two specimens which he figured, Reeve (1856) did not select a holotype, in view of which, the shell figured as no. 50 is here selected as lectotype.

Its comparatively large size, average length 65 mm., together with the broad spiral shelf formed by the angular structure of the upper part of the whorls next to the suture, will readily separate the race from any other.

Pomacea (*Pomacea*) *bridgesi diffusa* Blume.

Pomacea bridgesi diffusa Blume, 1957. *Opuscula Zoologica* Nr. 1, text-figs. a–c.

AMAZON REGION. Brazil : State of Pará, Cacaual Grande (Haas, 1952). Furo Mogoary, Belem (Lobato). Amazonas, Lago des Tres Casas, near Humaita, Middle River, Madeira (Haas). Ilha do Marayo, Largo Aria Swamp (Pain). Peru : Paca Concha, Pacalha, Rio Ucayali. Bolivia : Lagune in Santa Cruz (type, Blume).

This small, dark subspecies is one of the few *Pomacea* known to inhabit almost the entire Amazon system. It differs from the nominate race of *P. bridgesi* in respect of its much smaller size (average length 38 mm.), dark coloration and more produced spire, the whorls being in consequence less flattened above. It was described by Blume (1957) in order to draw attention to the existence throughout the Amazon Basin of a race of the strictly Bolivian *P. bridgesi*.

Pomacea (*Pomacea*) *scalaris* (d'Orbigny).

Ampullaria scalaris d'Orbigny, 1839. *Voy. dans l'Amér. Mérid. Bull.*, 374, pl. 50, figs. 1–3.
Ampullaria scalaris Reeve, 1856. *Conch. Icon. Mon. Ampullaria*, figs. 73a & b.
Ampullaria scalaris Kobelt, 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.* n.F., 184, pl. 6, figs. 6, 7.

AMAZON REGION. Bolivia : River Magdalena, 250 metres alt. (Haas, 1952).

RANGE : Bolivia, Paraguay, Argentina, Brazil, Uruguay ; in the Paraguay-Parana drainage.

Group of *Pomacea urceus* (Müller).

Pomacea (*Pomacea*) *urceus* (Müller).

Nerita urceus Müller, 1774. *Hist. Verm.*, **2**, 174.
Ampullaria oblonga Swainson, 1820–23. *Zool. Illust.* (1st. ser.), **3**, pl. 136.
Ampullaria guyanensis Kobelt (*non* Lamarck), 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.* pl. 68, fig. 1.
Ampullaria urceus Alderson, 1925. *Studies in Ampullaria* 10 (Synonymy), pl. 3, figs. 1, 2, 3.

AMAZON REGION. Brazil: Manaõs Prov., Rio Negro near Ilha Balisa; Archipelago das Anarilhanas, I. Sacada (Pain, 1939); Rio Branco, forest stream near Boa Vista (Pain, 1938). Peru: Cinco Capal, Aqua Calliente, Pachita, River Huanaco (Kummel, 1954).

RANGE: British and French Guianas, Venezuela, Colombia, Trinidad (B.W.I.), Peru, Brazil, Equador.

Typical *P. urceus* may best be described as very globose with a wide and deep umbilicus and a short spire. The interior of the wide aperture is creamy-white, often bluish towards the lip. The periostracum is thick and fibrous, varying in colour from straw-yellow to black. This subspecies is entirely without banding.

P. urceus attains gigantic proportions, a specimen 127 mm. in length, maximum diameter 115 mm., being obtained by the author in Trinidad, B.W.I. (San Fernando). Specimens in which the interior of the aperture and the columella show varying shades of red are not uncommon. In these, the periostracum varies from olive-green to dark brown, the lip and outer edge of the columella are creamy-white.

P. oblonga Swainson (1820–23) is in the author's opinion nothing more than an immature *urceus*. I have taken young specimens amongst adult shells which were indistinguishable from Swainson's figure of the type of *oblonga*.

Pomacea (*Pomacea*) *urceus guyanensis* (Lamarck).

Ampullaria guyanensis Lamarck, 1819. *Hist. Nat.* (ed. 1), **6**, 176; (ed. 2), **8**, 532.
Ampullaria puncticulata Swainson (*non* Reeve), 1822. *Zool. Illust.* (1st. Ser.), **3**, pl. 143.
Ampullaria erythrostoma Reeve, 1856. *Conch. Icon. Mon. Ampullaria*, fig. 59.
Ampullaria nobilis Reeve, 1856. Ibid., fig. 8.
Ampullaria haemastoma Reeve, 1856. Ibid., fig. 34.
Ampullaria guyanensis Kobelt, 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.* n.F., 186, pl. 67, fig. 1.
Ampullaria guyanensis Alderson, 1925. *Studies in Ampullaria*, 12, pl. 3, figs. 4, 6 and pl. 4, figs. 1–5.
Ampullaria guyanensis Mermod, 1952. *Rev. Suisse Zool.*, **39**, No. 2: les Types de la Collection Lamarck au Musée de Genève, **3**, 83, fig. 146.

AMAZON REGION. Brazil: Pará, Fortaleya de Jararaca, in the Furo Jararaca, 90 miles N.W. from Belem (Richardson, 1952); Rio Maranhãs (Yates); Amazonas, Ilha Grande de Gurupa in the River Murapucú; Ilha do Maraja, Lago Arary Swamp (Pain, 1939); Rio Jurua (Von Ihering). Peru: Quebrada at km. 14, Pucalpa Highway, Yucayali River (Kummel, 1954).

RANGE : British and French Guianas, Venezuela, Colombia, Brazil, Peru.

After careful examination of Lamarck's type in the Geneva Museum, I am convinced that a close relationship exists between it and *P. urceus*. Both will be seen to have an almost identical distribution. Although dark red mouthed examples of *guyanensis* with a fibrous periostracum occur, their noticeably pyriform shape is unmistakeable. Furthermore, the habitats of the two differ considerably, *guyanensis* being found in stagnant pools and swamps, *urceus* in small streams and forest pools. I have never found them occurring together in the same locality. *P. guyanensis* would therefore appear to be a race of *P. urceus* which has developed under ecological conditions very different from those in which the nominate race is accustomed to live.

P. nobilis (Reeve) I am unable to separate from typical *guyanensis*, the type being only a very large example of the latter. The curious shell figured by Alderson (*Studies in Ampullaria*, pl. 3, fig. 1), which he suggests might be a hybrid between *nobilis* and *urceus*, stresses the close relationship between these two forms. Its locality is unfortunately unknown.

P. puncticulata (Swainson) does not differ from *P. u. guyanensis* except in size. It is certainly not an immature shell as suggested by Hupé, for its lip is both thickened and reflected, a reliable indication of maturity. I have taken it in small savanna pools in British Guiana, and Dr. Weyrauch has sent me specimens from the Rio Negro. *P. puncticulata* is in my opinion a dwarf form of *guyanensis* inhabiting small bodies of water liable to dry up for considerable periods, and which is in consequence, of stunted growth.

On the authority of Sowerby (1909, 163) and Alderson (1952, 12), Pain (1950, 67) referred Reeve's *erythrostoma* to the synonymy of *guyanensis* and considered it as typical of the dark bandless form with a red aperture and columella, such as that figured by Alderson (1925, *Studies*, pl. 4, fig. 3). That Alderson's fig. 3 is certainly *guyanensis* is obvious from its characteristic pyriform shape. Reeve's type shell is, however, very similar to Alderson's alleged hybrid (pl. 3, fig. 1), as can be seen by comparing his fig. 59 in *Conch. Icon.* with that of Alderson mentioned above.

Pomacea (Pomacea) urceus yatesi (Reeve).

Ampullaria yatesi Reeve, 1856. *Conch. Icon. Mon. Ampullaria*, fig. 28.
Ampullaria yatesi H. Adams, 1866. *Proc. Zool. Soc. Lond.*, 440.
Ampullaria yatesi Kobelt, 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.* n.F., 200, pl. 72, fig. 1.

AMAZON REGION. Peru : Rio Maranon (type, Yates) ; Rio Jurua (Von Ihering) ; Rio Ucayali (H. Adams, 1866).

RANGE : Known only from Peru.

Pomacea (Pomacea) urceus olivacea (Spix).

Helix olivacea Spix, 1827. *Test. Fluv. Brasil.* pl. 3, fig. 1.
Ampullaria olivacea Philippi, 1851. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.*, p. 15, pl. 4, fig. 1.
Ampullaria olivacea Reeve, 1856. *Conch. Icon. Mon. Ampullaria*, fig. 38.
Ampullaria olivacea Kobelt, 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.* n.F., 161, pl. 60, fig. 1.

AMAZON REGION. Brazil: Manaõs, Rio Negro, Ilha Sacada, Bahia Botaen, Chavascal (swampy forest), near Ilha Balisa (Pain, 1938); San Francisco (Bequaert, 1925); Rio Solimões, Japura (Spix).

RANGE: Brazilian Amazon.

Reeve (1856) noticed the resemblance between *olivacea* and *P. urceus* (Müller). The former is usually without bands, the fibrous periostracum is lighter both in colour and texture than in typical *urceus*. The umbilicus is very narrow, almost closed in some specimens I have examined. I have seen no specimens which could be considered intermediate between the two forms, neither have I found them living together. *P. u. olivacea* would appear, therefore, to be a distinct subspecies inhabiting swampy forests along the Rio Negro and the Amazon in the vicinity of Manaõs. It is a somewhat rare and local race.

Pomacea (*Pomacea*) *quercina* (Spix).

Helix quercina Spix, 1827. *Test. Fluv. Brasil.* pl. 3, fig. 2.
Ampullaria quercina Philippi, 1851. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.*, 15, pl. 4, fig. 2.

AMAZON REGION. Urucurituba, Ilha Tupinambaranas, in swamps near Capella, Uruba, Bõa Esperance (Pain, 1939); Rio Solimões, Japura (Spix).

RANGE: Amazon drainage.

This rare and distinct species I have seen only from the above localities, where it occurs in ponds left by the inundation of the rivers. The aperture and columella vary in colour from orange to pale yellow. The lip is white in all specimens seen; a few narrow green bands are present on the spire of some. Often, however, these are entirely absent.

Pomacea (*Pomacea*) *zischkai* Blume and Pain.

Pomacea zischkai Blume & Pain, 1952. *J. Conch.*, **23**, 267, pl. 7.

AMAZON REGION. Bolivia: Region of the Rio Chapare, an affluent of the Amazon at 400 metres altitude (Zischka).

RANGE: Known only from the type locality.

Pomacea (*Pomacea*) *papyracea* (Spix).

Ampullaria papyracea Spix, 1827. *Test. Fluv. Brasil.* pl. 4, fig. 12.
Ampullaria papyracea Philippi, 1851. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.*, 11, pl. 2, figs. 1, 4.
Pomacea papyracea Pain, 1950. *Proc. Malac. Soc. Lond.*, **28**, 66, pl. 6, fig. 1.

AMAZON REGION. Brazil: State of Para, Thomé Assú in the Rio Acará (Haas, 1949); Prov. Amazonas, Ilha Grande du Gurupa in the Rio Murupucú; Ilha Marazo, Lago Arari swamp; Ilha Tupinambaranas in swamps near Capella; Ilha Uruba, Boã Esperance, Furo de Ramos, all in Urucurituba; Prov. Manaõs, Rio Negro, Ilha Sacada, Chavascal in swampy forest; Rio Branco, near Boã Vista (Pain, 1938); Meobamba (Spix). Peru: Rio Ucayali (H. Adams, 1866).

RANGE : Venezuela, British Guiana, Brazil, Peru.

This beautiful species is absolutely distinct from any other known form. Young shells are black and extremely thin and fragile. It is always unbanded and when adult becomes reddish-brown, white within. *P. papyracea* is amongst the largest known species, an example taken by the author near Boã Vista on the Rio Branco measuring 110 mm. in diameter. Although rare in collections, *P. papyracea* is very abundant in the swamps where it occurs.

Subgenus *Limnopomus* Dall.

[Type *P.* (*L.*) *columellaris* (Gould)].

Pomacea (*Limnopomus*) *columellaris* (Gould).

Ampullaria columellaris Gould, 1948. *Otia*, 51.
Ampullaria columellaris Kobelt, 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.* n.F., 164, pl. 60, figs. 6 & 7.
Ampullaria columellaris Alderson, 1925. *Studies in Ampullaria*, 54 (Synonymy), pl. 11, fig. 8.

AMAZON REGION. Peru : Hacienda Cadena (1,000 metres alt.), Prov. of Quispicandi, Dept. of Cuzco (Haas, 1952) ; Rio Camchurras (Da Costa) ; Quebrada, Aqua Blanca, Aqua Caliente, Huanaco (Kummel, 1955) ; Tarapoto (Spruce) ; Rio Ucayali, Cantamena (Schunke) ; Rio Chinchipe, Dept. Cayamarca (Angrande) ; Tingo Maria, Rio Hullago (Weyrauch).

RANGE : Peru, Bolivia, Equador (?).

Typical *columellaris*, such as that figured by Alderson (1925), would seem to occur throughout the headwaters of the Amazon and its tributaries. Alderson's shell, which came from the De Burgh collection, is labelled " Amazon ". The shells recorded by Haas are a high-spired form, by no means typical, but referred correctly in my opinion to *columellaris*. Red lipped examples are known from the Rio Ucayali in Peru ; a dwarf race of apparently adult shells with thickened and reflected lips was taken by Kummel at Aqua Calliente, the largest of these being only 31 mm. high by 25 mm. max. diameter.

Pomacea (*Limnopomus*) *crassa* (Swainson).

Ampullaria crassa Swainson, 1823. *Zool. Illust.* (1st. Ser.), **3**, pl. 136.
Ampullaria brownii Jay, 1836. *Ann. Lyc. Nat. Hist. New York*, **4**, 170.
Ampullaria pealeana Philippi, 1851 (*non* Lea, 1838). *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.*, 62, pl. 20, fig. 7.
Ampullaria impervia Philippi, 1852. *Zeitsch. f. Malac.*, **9**, 21.
Ampullaria solida Von Dem Busch, 1859. *Proc. Zool. Soc. Lond.*, 168, no. 3.
Ampullaria petiti Crosse, 1890. *J. Conchyl.*, **39**, 214, pl. 4, fig. 2.
Ampullaria crassa Kobelt, 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.* n.F., 189, pl. 67, figs. 5, 6, 9 and pl. 76, figs. 1, 2, 8, 9.
Ampullaria crassa Pain, 1950. *Proc. Malac. Soc. Lond.*, **28**, 72 (synonymy), pl. 7, fig. 7, pl. 8, fig. 13.

AMAZON REGION. Brazil : Fortaleya de Jararaco, Furo Jararaco, 90 km. N.W. of Belem, Pará State (Richardson, 1952). Peru : Rio Callanga at 1,500 m. ; Cattambo, near Cuzco ; Rio Madre de Dios, Cuzco (Weyrauch) ; Rio Negro near Roija, San Martin at 3,000 m. (Sowerby).

RANGE: Brazil, French, British and Dutch Guiana, Venezuela, Colombia, Equador, Peru, Bolivia.

This species enjoys a wider distribution than any other *Limnopomus* and is extremely variable in size, shape and colour, ranging from high-spired ovate shells described as *impervia* by Philippi (*petiti* Crosse), through typical *crassa* to globose shells with a short spire like Von Dem Busch's *solida* from Equador. Although often stated to be imperforate, narrowly umbilicate examples are not uncommon.

The species is usually distinctly banded, but unbanded shells are known; the height of the spire may vary considerably even amongst shells from the same locality.

To the list of synonyms given by Pain (1950, 72), should be added those shown above. Through the kindness of Dr. J. C. Bequaert and Dr. W. J. Clench, I have been able to examine the type of *A. brownii* Jay, and there is, in my opinion, no doubt that it is identical.

Pomacea (*Limnopomus*) *crassa nubila* (Reeve).

Ampullaria nubila Reeve, 1856. *Conch. Icon. Mon. Ampullaria*, figs. 65 a & b.
Ampullaria nubila Kobelt, 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.* n.F., 187, pl. 67, figs. 2–4.

AMAZON REGION. Brazil: Amazonas, Ilha du Para and Ilha du Queimada, Furo Grande (Pain, 1939); Rio Juruá (Von Ihering). Peru: Quebrada, Turicana, Pachitea River, Aqua Calliente; Conquembe near Is. Chonta, Huanaco (Kummel, 1955); affluent of the River Pachitea (Schunke).

RANGE: Brazil, Peru, Bolivia (in the Amazon drainage).

I have retained this form of *crassa* as a distinct subspecies since it is more constant in shape than any other known to me. The shell is normally narrowly umbilicate, although this feature may be reduced to a mere chink in some specimens. It is variable in thickness, but the round body whorl and elevated spire are characteristic. The strength of banding varies considerably, the curious cloud-like blotches of colour so noticeable in the type figure are often absent. I have never seen examples of *nubila* which had been found in association with typical *crassa*. The round body-whorl and elevated spire separate it from all other forms of *crassa*.

Pomacea (*Limnopomus*) *cyclostoma* (Spix).

Ampullaria cyclostoma Spix, 1827. *Test. Fluv. Brasil.* 4, pl. 4, fig. 5.
Ampullaria elegans d'Orbigny, 1835. *Mag. Zool.*, 53.
Ampullaria pulchella Anton, 1839. *Verg. Conch.*, 50.
Ampullaria roissy d'Orbigny, 1839. *Moll. Voy. Amer. Mérid.*, 337, pl. 52, figs. 1–3.
Ampullaria cyclostoma Kobelt, 1915. *Mon. Ampullaria* in *Mart. & Chem. Syst. Conch. Cab.* n.F., 189, pl. 61, figs. 3–5, pl. 68, figs. 5–6.

AMAZON DRAINAGE. Bolivia: Magdalena, Amazonian region at 250 m. altitude (Zischke); Rio Madeira, tributary of the Amazon (d'Orbigny).

RANGE: Argentina, Paraguay, Uruguay, Bolivia, Brazil (Paraguay-Parana drainage).

Haas (1932, 132) referred one specimen collected by Zischka from Bolivia (Amazon drainage) to *elegans* d'Orbigny, which he considered a subspecies of *cyclostoma* Spix. For reasons not stated he placed this in the subgenus *Effusa*, from which one is bound to conclude that his shell could not have been any form of the true *cyclostoma*, which is a typical *Limnopomus*. D'Orbigny's true locality for his *elegans* was in any case a Bolivian tributary of the Amazon, so a further record from this area is to be expected. It should be borne in mind that not one species of *Pomacea* from the entire Amazon region has been referred to the subgenus *Effusa*.

After examination of many specimens, I am unable to separate *elegans* from typical *cyclostoma*.

CONCLUSIONS. In view of the vast area drained by the Amazon and its tributaries, any account of the Mollusca inhabiting it must of necessity be incomplete. So far as the *Pomacea* are concerned, this state of affairs is likely to continue, since the vast areas of swamps and rivers, a country better suited to the development of these large marsh snails than perhaps any in the world, can be expected to produce many new forms as its exploration is pushed forward, a process which at the present rate is likely to take several hundred years. However, several interesting facts emerge from a systematic study of the species and subspecies already known.

Amongst *Pomacea s.s.*, only one species is found to be common both to the Amazon basin and that of the Parana-Paraguay to the south, viz. *P.* (*P.*) *scalaris* (d'Orbigny), whereas at least four are found also in the rivers of British Guiana and Venezuela: *P.* (*P.*) *papyracea* (Spix), *P.* (*P.*) *urceus* (Müller), *P.* (*P.*) *urceus guayanensis* (Lamarck) and *P.* (*L.*) *crassa* (Swainson). It is, however, curious that the subgenus *Effusa* so common in the Guiana region, is unknown. Some closer connection with the species inhabiting the Orinoco system is to be expected, since that river is joined to the Rio Branco by the Casiquiare channel.

Although the usually thick-shelled, often imperforate species of the subgenus *Limnopomus* have generally been considered as inhabiting swiftly flowing streams, usually in mountainous regions, recent researches in the lower Amazon have shown that such is not always the case, *P.* (*L.*) *crassa* (Swainson) and its subspecies *nubilia* (Reeve) having been taken in Pará State. All the *Limnopomus* found in the Amazon drainage are species having a wide distribution and none is peculiar to it.

Of the remaining *Pomacea* so far recorded and which after careful consideration I have retained as species or subspecies, all are known only from the Amazon drainage, and there are no reliable records for them from elsewhere.

Recent investigations show that many of the Amazon *Pomacea* have a far wider distribution than was imagined by their original authors, which is to be expected when one bears in mind the very uniform conditions which exist over so vast an area. There is little doubt that future systematic collecting will tend to reduce the number of these species still further as larger series of specimens become available for examination and comparison, especially amongst those described originally upon inadequate material.

A comprehensive list of species is given by Lange de Morretes (1949, 66), together with their distribution so far as Brazil is concerned. Sowerby (1909) also gives a list of species described up to that time.

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Early breeding of *Marpessa laminata* (Montagu).—Two snails of this species were seen mating on 28 February 1960 at Long Wood, Clement's End, near Studham, Bucks. It was a mild day, with the temperature well above 50° F., bright and sunny ; even so, this seems rather an early date.

L. W. STRATTON.

***Columella edentula* (Draparnaud) and *Vertigo antivertigo* (Draparnaud) in West Sussex.**—*Columella edentula* was found at Henley Common (SU 888260) on the east or down-slope side of the main Fernhurst–Midhurst road as it ascends the Lower Greensand escarpment, in September 1956, on *Scirpus sylvaticus*. *Vertigo antivertigo* was found on marshy ground amongst reed debris by a hammer-pond near Bobbold's Farm, Chithurst (SU 833264), associated with *Lymnaea truncatula*, *Zonitoides nitidus* and *Euconulus fulvus*. In the 1951 edition of the Census, both these species are indicated as unconfirmed for vice-county 13.

M. GOODCHILD.

SOME VARIATIONS IN THE UNIONIDAE

By L. W. Stratton

(*Read before the Society*, 9 *April* 1960)

The following is an account of a Unionid population in which a considerable amount of variation was observed.

This unusual colony of Unionidae lives in a backwater of the River Thames a short distance above Windsor Bridge on the north side of the river. It is found along the base of a concrete wall, in water varying from four to five feet in depth. The shells are most abundant close up under the wall, where the bottom consists of thick mud; further out, on a gravelly bottom, only stray shells occur.

The colony was first discovered in 1949, when four species were taken: *Anodonta anatina* (Linné), *Anodonta minima* Millet, *Unio pictorum* (Linné) and *Unio tumidus* Philipsson. *Sphaerium rivicola* (Lamarck) and *Viviparus viviparus* (Linné) were also present.

The *A. anatina*, of which the largest shell measured 83 mm. in length, were of the typical form, the dorsal margin ascending to an obtuse angle before curving downwards to the posterior end. Three *A. minima* were taken, the largest measuring 82 mm. *U. tumidus* was also typical of the species, measuring up to 74 mm. They were handsome shells, corresponding to the description by Ellis (1947), brown " with alternating zones of paler hue, greenish, marked with divergent yellow rays ". There were two forms of *U. pictorum*, the typical one and that attributed to var. *curvirostris* Dupuy. These were all rather small, up to 72 mm. long in the typical form and 70 mm. in *curvirostris*. The colour was pale, a deep straw colour with concentric bands of dark brown which widened towards the ventral margins. Some of the typical shells had traces of green colour. The *curvirostris* shells were much shorter in relation to width when compared with the shell figured by Ellis (1947, plate 6, figure 27), which measures 93 × 41 mm., and approach much more nearly to figure 28 on the same plate. The measurements of three preserved specimens are 72 × 36 mm., 65 × 31 mm. and 66 × 38 mm., the last being slightly deformed in front of the umbones. The ventral margins are generally more incurved than in Ellis's specimens. In all, the teeth and muscular impressions are typical of *U. pictorum*.

In 1958 a sample of shells was taken from the same place, and it became clear that significant changes had taken place in the population. The same four species occurred. Only two *A. minima* were taken, and these were much smaller than the 1949 specimens. Two distinct forms of *A. anatina* were found, neither conforming to that of 1949. Of 30 shells taken, 17 approached most nearly to the form *incrassata* Sheppard, and 13 to *rostrata* Rossmässler, as figured by Bloomer (1938). The largest shell of the former measured 80 mm. in length, and of the latter 92 mm., and the average size of the whole sample was greater than that of 1949. In the extreme form of *incrassata* the angle at the posterior end of the hinge-line was entirely absent, the shell being oval in outline. In the *rostrata* form the hinge-line was short, there was an obtuse angle quite close to the umbones, and the posterior end of the shell was long, slightly incurved on the dorsal side and wedge-shaped. Between these two extremes were many which were intermediate, and some were difficult to separate. The coloration was generally brown, with still darker brown growth lines. In some cases the young shell, up to 35 mm., showed clearly round the umbones, being a pale greyish-brown colour.

Five juveniles measuring 14 mm., 24 mm., 30 mm., 31 mm. and 36 mm. in length were taken. The first two showed the incurved hinge-line figured by Kennard, Salisbury and Woodward (1925, plate 13), but in the last three it was straight. The dorsal margin of all these shells rose steeply from the umbones to an angle, which could also be seen in the same parts of the adult shells mentioned above. This angle was lost in the adult *incrassata*, but maintained in the *rostrata*. The colour of these juveniles was the same greyish-brown, and each had two greenish rays radiating from the umbones to the posterior end. In only one adult shell was there any trace of green colour.

The *Unio* population was even more interesting, for the colony seemed to have developed what may be described as a *curvirostris* complex. The average size of the shells was also a good deal larger than the 1949 samples. The changes seem to justify more detailed descriptions.

SIZE

U. tumidus : the two largest shells were 91 mm. and 90 mm. in length and several others were larger than the 1949 shells.

U. pictorum : 88 mm. was the maximum length, the average of eight shells being 76 mm.

var. *curvirostris* : largest 88 mm., the average of eight shells 75 mm.

COLORATION

U. tumidus : brown, with dark brown growth lines, paler at the umbones ; the " dark form " of Kennard, Salisbury and Woodward (1927). There was no green colour in any shell and the pale rays were entirely absent.

U. pictorum : much darker than the 1949 shells ; brown with dark concentric bands, but not so dark as the *U. tumidus* shells.

var. *curvirostris* : a good deal of variation in colour, from dark *tumidus* brown to the pale yellowish-brown of the 1949 shells. All had dark concentric bands which varied a good deal in width. In some shells these bands were of a fibrous nature. There is often a fibrous edge along the ventral margin of *U. pictorum*, which had obviously been preserved during growth and not overlaid with shelly substance as is usually the case.

FORM

U. tumidus : while some shells were slightly more elongated than others, all but two maintained the typical outline of the species. These two, however, had ventral margins slightly incurved, giving them a *curvirostris* appearance.

U. pictorum : generally typical, with subparallel dorsal and ventral margins ; two with incurved ventral margins and one with the ventral margin convexly curved as in *U. tumidus*.

var. *curvirostris* : a good deal of variation, the one constant feature being that described by Ellis (1947), " posterior end curved and wedge-shaped, bringing the extremity below the longitudinal axis of the shell." The anterior ends varied considerably, some being typical of *U. pictorum*, " the dorsal margin almost straight and continued well in front of the umbones passing abruptly into the rounded anterior margin " (Ellis). In others the margin fell away abruptly from the umbones as in *U. tumidus*. There were intermediates between these two extremes. The ventral margins varied from incurved, through straight to convex curves.

RUGAE

U. tumidus : all showed the typical W formation.

U. pictorum : typical of the species.

var. *curvirostris* : in all but three the umbones were more or less eroded so that the rugae were obliterated. In these three the rugae were typical of *U. pictorum*.

TEETH

U. tumidus : all typical.

U. pictorum : all typical.

var. *curvirostris* : again there was a great deal of variation, though in most shells the teeth were nearer to *U. pictorum*. In one shell the inner anterior lateral of the right valve was as large as in *U. tumidus*, with the outer tooth vestigial. In two the cardinals and anterior laterals were continuous, forming one long tooth. There were other minor variations.

MUSCULAR IMPRESSIONS

U. tumidus : all typical.

U. pictorum : all typical.

var. *curvirostris* : much variation, both in shape and position of the scars. In some shells the anterior adductor and anterior retractor-pedis scars were separated by a high ridge ; in others the two scars were contiguous. The distance of the scars from the dorsal margins also varied. In some shells the protractor-pedis was broad as in *U. pictorum*, in others narrow and crescentic as in *U. tumidus*. The posterior adductor scars varied from shell to shell, some being ovoid as in *U. pictorum*, some spade-shaped as in *U. tumidus*, and some of these latter showed the herring-bone pattern often found in *U. tumidus*.

It will be seen from the above descriptions that some of the true *U. tumidus* and *U. pictorum* showed certain unusual features. The rest must be assigned to *U. pictorum* var. *curvirostris*, but quite a number of them exhibited *U. tumidus* resemblances both in teeth and muscular impressions.

In addition to the shells already described, there was one which may be described as intermediate between *U. tumidus* and *U. pictorum*. The colour and outline were most nearly that of *U. pictorum*, with a tendency towards the *curvirostris* posterior curve. The anterior lateral teeth of the right valve were as in *U. pictorum*, though the inner tooth was rather large.

The anterior laterals of the left valve approached more nearly to *U. tumidus*. The muscular impressions were all those of *U. tumidus*. This shell is very similar to one taken in 1947 from the River Lea at Broxbourne, Herts. In this shell the teeth were all *U. pictorum* and the muscle scars all *U. tumidus*. Mr. Salisbury and Mr. Ellis agreed that this shell was an intermediate between the two species.

It was felt that further investigation was desirable, so the locus was visited again in 1959. No great changes were expected, but some confirmation of the 1958 findings was hoped for. Twenty-two specimens of *Anodonta* and 30 of *Unio* were taken. There was no specimen of *A. minima*, all 22 being *A. anatina*. Of these, six were of the typical form, with steep hinge-line and clear-cut angle, nine were the *incrassata* form with oval shell, and seven the *rostrata* form with wedge-shaped posterior end. Coloration was much as in 1958, though several shells showed traces of green. The shells were generally large, the largest of each form measuring 84 mm., 90 mm. and 102 mm. respectively.

Of the 30 *Unio* taken, eleven were *U. tumidus*. All but one were of the dark form, the exception being paler with green rays. The largest shell measured 93 mm., the average of the eleven was 82 mm. and the ratio of length to height was 1·95/1. As in 1958, two shells had incurved ventral margins.

Only one typical *U. pictorum* was taken, a half-grown yellow and green shell of 71 mm., rather short for the species, the ratio being 2·44/1.

Of the remaining 18 shells, 17 must be assigned to the form *curvirostris*. As in the 1958 sample there was considerable variation in shape, some approaching that of *U. tumidus* with convex ventral margins, others straight or incurved. The two largest shells each measured 87 mm., the average was 75·7 mm. and the ratio 2·09/1. Coloration was as in 1958, and both teeth and muscular impressions showed similar variations. In several shells the ligament approached more nearly to *U. tumidus* than to *U. pictorum*. There were fewer eroded shells, and all showing the rugae were typical of *U. pictorum*.

Again there was one shell with unusual features, but in many ways different from the "intermediate" of 1958. On outward appearance it would be assigned to *U. tumidus*, but the shell was abnormally thin, like an *Anodonta*. The rugae resembled *U. pictorum*, the ligament *U. tumidus*. The teeth of the left valve were nearer to *U. pictorum*, those of the right valve to *U. tumidus*. The muscle scars were generally nearer to *U. pictorum*, though the anterior adductors had *U. tumidus* affinities. This shell may be described as an intermediate.

This 1959 sample of *Unio* produced another peculiarity. Several shells had present in the interior a brown incrustation of a material similar to that of the ligament. One *curvirostris* shell had the teeth completely covered with this material, two *U. tumidus* had deep pits beneath the umbones filled with it, and another *curvirostris* shell had a similar pit near the ventral margin. The sample also showed several cases of deformity, especially in the teeth.

Kennard, Salisbury and Woodward, in their 1927 paper on the *Unio* from Repton Park, Derbyshire, refer to them as "hybrids". This term has been omitted deliberately from this paper, as there is no evidence of interbreeding between the two species of *Unio* in the River Thames locus. It may have occurred, but it was thought better to use the term "intermediate". The Repton Park locus was a running pond, closed at the lower end by a dam, so that interbreeding in such a confined locus was a distinct possibility. The locus of this paper is a backwater with free access to the main stream of the River Thames some sixty yards away.

Summary

The Unionid population of the River Thames locus has, in ten years, reached a stage of considerable variability. Three forms of *Anodonta anatina* have developed. In *Unio*, the form of *tumidus* seems to have remained fairly constant, but in *pictorum* the *curvirostris* form has almost entirely superseded the typical form. It also shows signs of *tumidus* affinities. Two shells have been found which may be described as intermediates between the two species of *Unio*.

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***Hygromia subvirescens* (Bellamy) in Pembrokeshire.**—The occurrence of this species in Wales was known from a single shell collected at Newgale, Pem., by Mr. R. P. Smith, of Belmont, Surrey, in 1938; this specimen is in the British Museum (Natural History). At the suggestion of Mr. A. E. Ellis, I searched for *H. subvirescens* in Pembrokeshire in August 1959, and discovered two colonies on cliffs near St. Bride's Haven (SM 804114). The coast-line is deeply indented, with cliffs of Old Red Sandstone falling steeply to the sea from a height of about 70 feet. Both colonies were on slopes facing south-west, and extended down almost to the limit of vegetation, but were confined to within a few yards of the cliff top above. Low down the cliff the snails lived under mats of sea campion (*Silene maritima*) on bare well-drained sandstone, where the only associated species was *Lauria cylindracea*. Higher up they were found under sea campion, thrift (*Armeria maritima*) and ribwort plantain (*Plantago lanceolata*), together with *Cochlicopa minima*, *Vertigo pygmaea*, *Helix nemoralis*, *Helicella caperata*, *Oxychilus alliarius* and *Vitrina pellucida*. Choughs were seen probing the grassy slopes of nearby cliffs: they are probably one of the predators of this snail.

L. Lloyd-Evans.

NEW SPECIES OF SOUTH AFRICAN MARINE GASTROPODS

By K. H. BARNARD

THE following species, together with several other interesting species (cf. *J. Conch.* **24**, 398), have recently been dredged in deep water off Cape Point by Mr. F. H. Talbot, Marine Biologist, South African Museum.

CANCELLARIIDAE

Cancellaria euthymei *n. sp.* Fig. 1 *b.*

Shell thin. Aperture twice spire (as preserved). Protoconch missing. Three whorls preserved; profile evenly convex. No axial sculpture, except at irregular intervals some of the growth-lines are slightly more

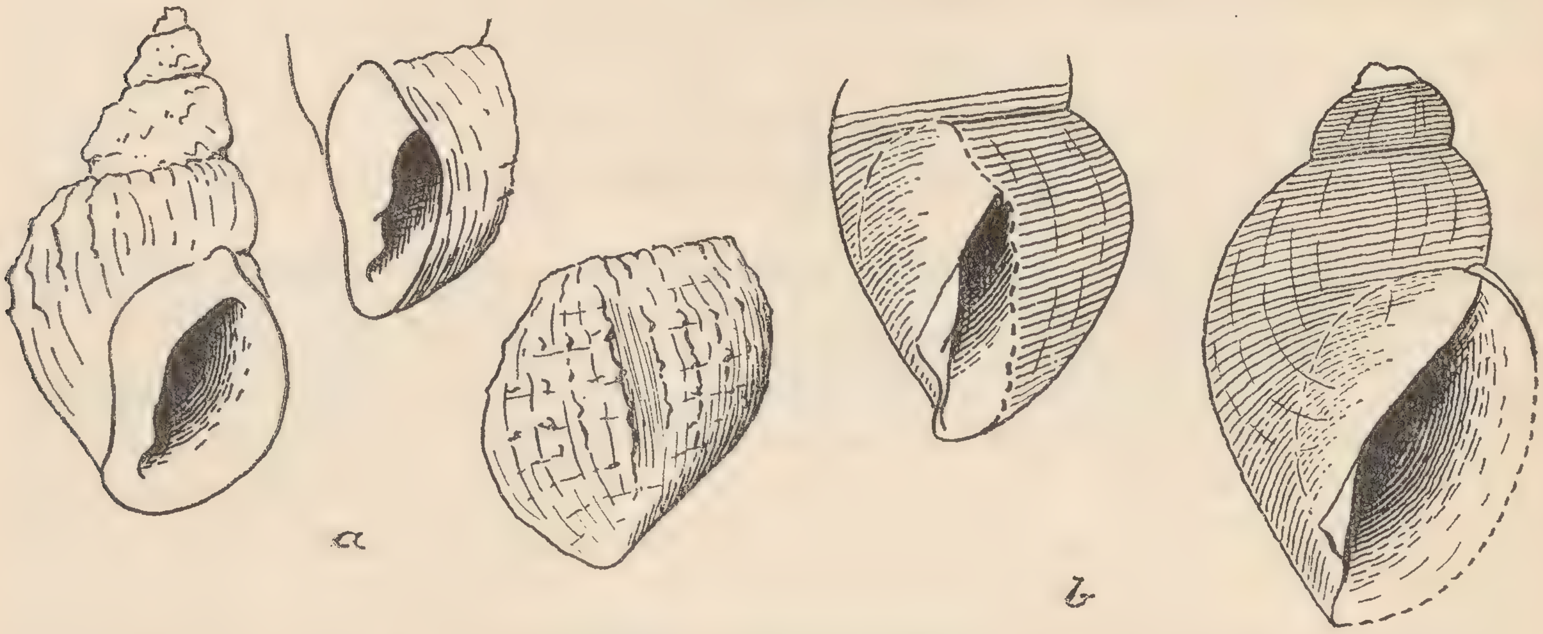


FIG. 1. *a. Admete decapensis* n. sp. *b. Cancellaria euthymei* n. sp.

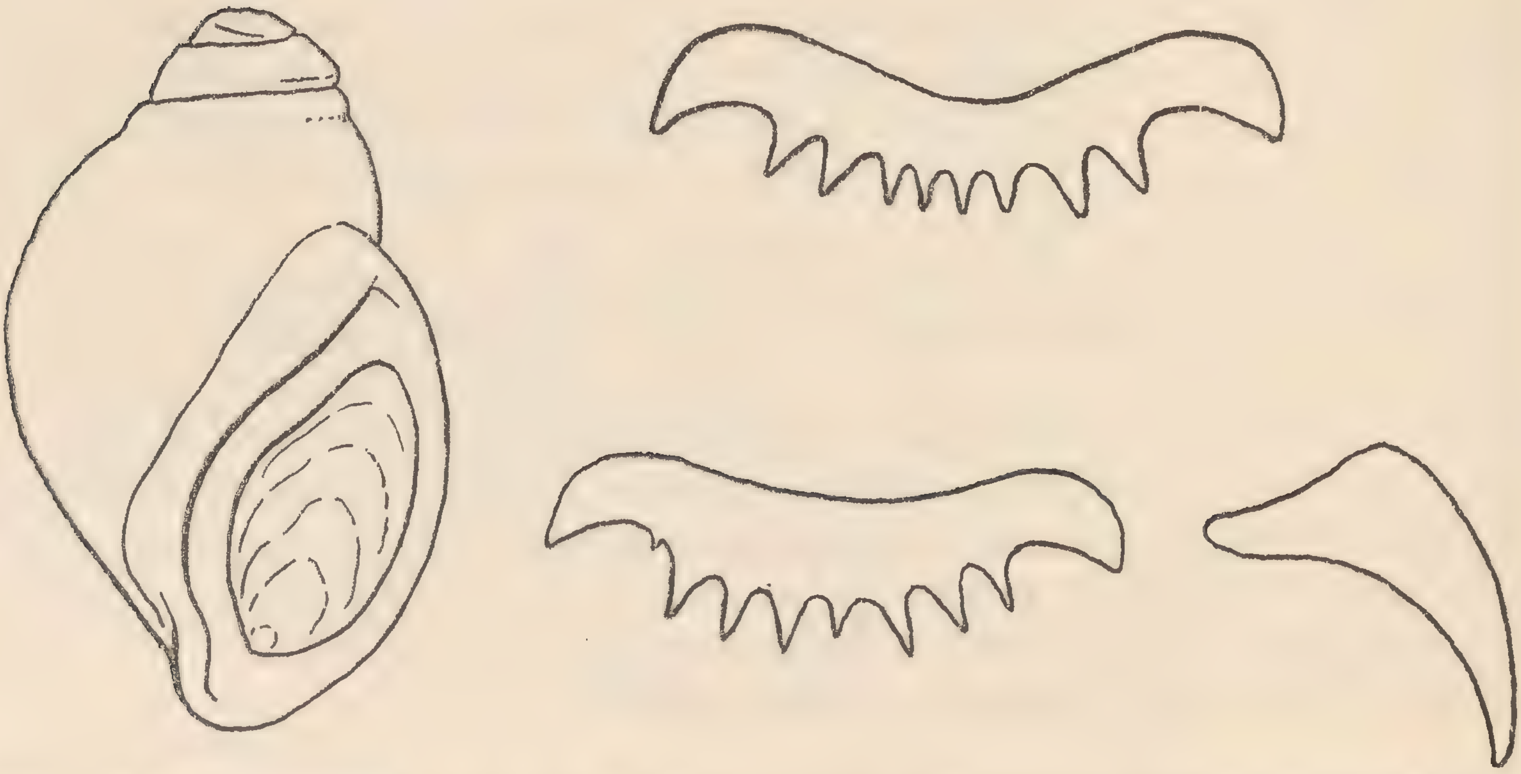


FIG. 2. *Nux alabaster* n.g., n. sp. Shell; central and lateral plate of radula of A9715 (below), central plate of A9827 (above).

prominent than elsewhere. Spiral lirae on penultimate whorl 11, on last whorl 14, on base *circa* 30 plus a few faint ones on snout. Columella with a feeble pleat; columellar glaze thin, not concealing the lirae. An umbilical chink. Edge of outer lip broken. 9·5 × 6 mm. White, translucent.

Animal pale cream. Eyes distinct. Gill blackish, showing through the shell. Radula normal (*cf.* Barnard, 1958, 1959).

34° 36′ S. 17° 00′ E. 1500–1760 fathoms, one living. S. Afr. Mus. A9888 (Holotype). F. H. Talbot coll.

Remarks.—The shell seems to be not fully adult, as the columellar glaze is thin; the umbilical chink would probably be glazed over in adult.

Resembles somewhat Sowerby's figure (1849. *Thes. Conch.* **2**, pl. 96, figs. 100, 101) of *C. couthoyi* [*sic*] Jay. Later *couthouyi* was regarded as a synonym of *Admete viridula* (see Verrill, 1884, *Trans. Conn. Ac. Arts & Sc.* **6**, 1, 265), occurring off the east coast of North America and in the North Atlantic, 155–1255 fathoms.

Named after le Frère Euthyme, with allusion to the well-disposed (regularly arranged) and generous (numerous) spiral lirae.

Admete decapensis *n. sp.* Fig. 1 *a.*

Apex and whole surface more or less corroded. Spire rather high. Remains of an apical whorl, plus 4 whorls. Last whorl with oblique axial, slightly retractive ribs, *circa* 14 traceable, but probably full number nearer *circa* 18; on back of outer lip, where surface is corroded, close-set growth-lines appear. Seven or eight spiral series of tubercles on the ribs. Aperture semi-circular, outer lip not reflexed, no internal plicae. Columella with two feeble pleats (or only one if the lower edge of the columella be not counted); columellar glaze extensive; no umbilical chink. 27 × 15 mm. Dirty chalky-white. No operculum.

Animal pinkish. Eyes present. No radula.

34° 37′ S. 17° 03′ E. 1580–1620 fathoms, one living. S. Afr. Mus. A9777 (Holotype). F. H. Talbot coll.

Remarks.—Resembles in shape the Arctic *A. viridula* (Fabricius) var. *producta* Sars (1878. *Moll. Reg. Arct. Norv.* pl. 13, fig. 2); and is closely comparable with *A. nodosa* Verrill & Smith (1885. *Trans. Conn. Ac. Arts & Sc.* **6**, 2, p. 419, pl. 44, fig. 9) from the New England coast, 816–924 fathoms.

Family ? (Rhachiglossa).

Nux *n.g.*

Shell ovoid. Columella curved, no canal, outer lip joining columella to form a broad open channel. Operculum oval, nucleus apical.

Radula with short, wide central plate, concave in front, 7–8 cusps; and triangular, unicuspid lateral plate.

Genotype: *N. alabaster* n. sp.

Remarks.—The shell is Naticoid in appearance (*cf.* some species of *Lunatia*), but completely imperforate; the operculum is Buccinoid; and the radula resembles that of *Cyllene* and some Mitrids.

The shell shows some resemblances to *Benthobia tryonii* Dall (1889.

Bull. Mus. Comp. Zool. Harv. **18,** 132, pl. 35, fig. 6), which Dall, in the absence of the soft parts, suggested might be related to *Admete.* The radula of the present species, however, indicates that it belongs to one of the Rhachiglossate families.

Nux alabaster *n. sp.* Fig. 2.

Shell covered with a fine homogeneous chalky-white deposit; apex partly corroded; when cleaned the shell has an alabastrine texture. Protoconch corroded. Postnatal whorls 3½–4. Surface smooth, on last whorl some of the growth-lines thickened and simulating axial pliculae, especially on back of outer lip. Columellar glaze extending to snout. 11 × 6·5 mm.

Radula: of A9715 with at least 60 rows, central plate with 7 cusps, the median one slightly smaller than the others, a minute denticle on one side external to the outermost cusp; of A9827 with *circa* 80 rows, central plate with 8 cusps, the 4 middle ones smaller than the 2 outer ones on either side.

33° 26′ S. 16° 33′ E. 1,300 fathoms, one living; S. Afr. Mus. No. A9715 (Holotype). 33° 52′ S. 16° 51′ E. 1,380–1,520 fathoms, 2 living No. A9827. F. H. Talbot coll.

CYMATIIDAE

Thalassocyon *n.g.*

Shell pyriform, spire low. Protoconch ? Whorls angulate. Columella straight, without pleats. Canal long and narrow. Operculum small, rounded-triangular, nucleus apical.

Jaws present. Radula small, resembling that of *Cymatium.*

Genotype: *T. bonus* n. sp.

Remarks.—The shell has the appearance of a *Semifusus*, and it was surprising to find the radula was taenioglossate.

I hope Mr. Talbot will pardon the heraldic allusion to his name. "Sea-dog: an animal resembling a talbot . . ." (a fleet and energetic hound).

Thalassocyon bonus *n. sp.* Fig. 3.

Protoconch broken, apical whorls corroded. Postnatal whorls 5 or 6. Profile of 3rd and 4th whorls angular a short distance above the suture. On penultimate and ultimate whorls the angular shoulder forms a sharp keel; on 4th whorl with irregular (*circa* 12 in ♀ shell) lobes, mostly worn away, on 5th whorl with 14 (♀), 9–10 (smaller ♂) outstanding, complanate triangular lobes, hollow in front (some of them broken off); the larger ♂ has 16–17 lobes on the 6th whorl, those on the ventral (apertural) surface mostly worn or broken off. No distinct axial ribs, but usually a more or less distinct (more distinct in ♀ than in ♂) retractive plicula from the suture down to each lobe, and continued below the lobes across the base. Spiral lirae 7–8 on 3rd whorl, 9–10 on 4th, 10–12 on 5th, often with finer intermediaries, on base *circa* 40 plus intermediaries; both above and below the peripheral lobes the lirae curve outwards on to the lobes. Rostrum straight (slightly curved in largest ♂) ; aperture pyriform. 50 × 29 (incl. lobes) mm. (♀) ; 48 × 25 mm. and 75 × 37 mm. (♂♂).

Operculum in smaller ♂ (missing in ♀ and larger ♂) much smaller than aperture, rounded-triangular, nucleus apical, 5·5 × 4 mm.

Pale buff, columella and interior of aperture pinkish-mauve ; operculum amber.

Animal pale, liver greenish-black. No eyes. Jaws present, radula situated immediately behind them.

Radula with *circa* 85 rows, central plate with lateral, expansions wider than long, median cusp with 2 denticles on each side, lateral plate with 3 denticles on outer margin of cusp, both marginal plates simple.

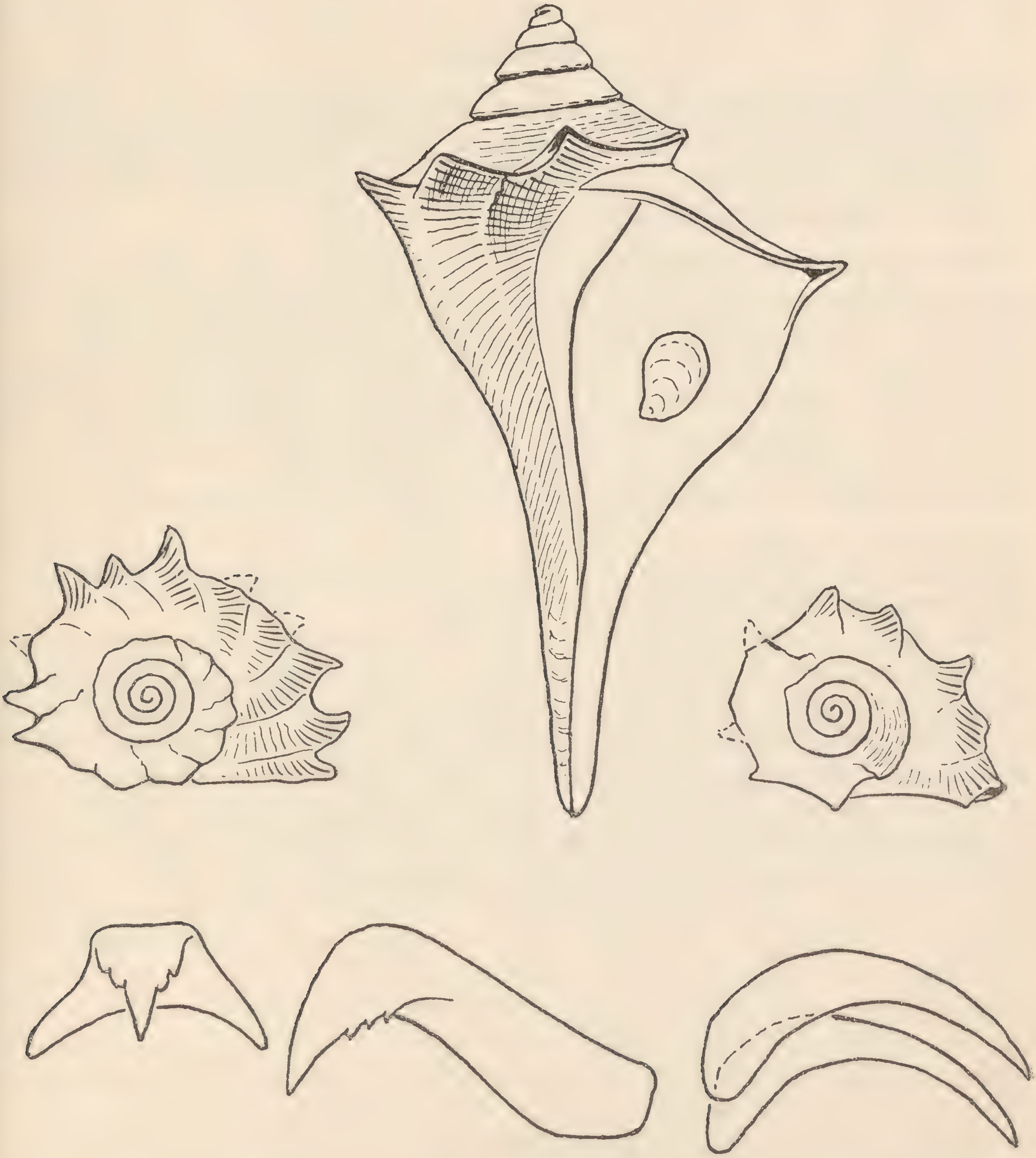


FIG. 3. *Thalassocyon bonus* n.g., n. sp. Shell of A9714 ♂ ; apical view of A9715 ♂ (right) and A9756 ♀ (left) ; radula.

33° 26′ S. 16° 33′ E. 1,240–1,300 fathoms, one ♂ living (Holotype); 33° 49′ S. 16° 30′ E. 1,500 fathoms, one ♀ living; 34° 37′ S. 17° 03′ E. 1,580–1,620 fathoms, one dead; 33° 50′ S. 16° 30′ E. 1,480–1,660 fathoms, one ♂ living. S. Afr. Mus. A9714 (Holotype), A9756, A9779, A9810. F. H. Talbot coll.

Remarks.—In shape the shell resembles *Semifusus tuba* (Gmelin) (see Chenu, *Manuel*, 1859, fig. 615).

A very similar shell is illustrated in the right-hand figure on p. 187 of the *Galathea Deep Sea Expedition* 1956, but no locality is given.

REVIEW

A monographic revision of the African land snails of the genus *Burtoa* (Mollusca–Achatinidae). T. E. Crowley & T. Pain. Annales du Musée royal du Congo belge, Tervuren (Belgique). December 1959. Série in 8°. Sciences zoologiques, vol. 79, pp. 1–35, pl. 1–3.

For the purpose of this monograph the authors have gathered from many museums and private individuals more examples of the genus than have ever been collected in one place before. After exhaustive studies the authors have felt obliged to discard ten of the described species and subspecies (most of them created by Bourguignat), leaving seven standing as valid. Of these seven, however, two are new names proposed by the authors. A new fossil species is figured and described.

This process of reducing some names to synonmy and the erection of new species or subspecies is inevitable when a wider view of a group is taken and all its relationships, both in time and space, are taken into consideration, with ample material available.

The work is well illustrated and the three plates with 13 figures give a good idea of the range of size and shape of the subspecies in the genus. We presume the excellent photographs are natural size though nowhere is it so stated. The thanks of conchologists are due to the Belgian authorities for the quality of the production. In spite of the amount of work done the authors, in their conclusion, adumbrate further studies and request material for these. From the excellent map one would think the authors had covered all the ground, but apparently not.

H. E. J. Biggs.

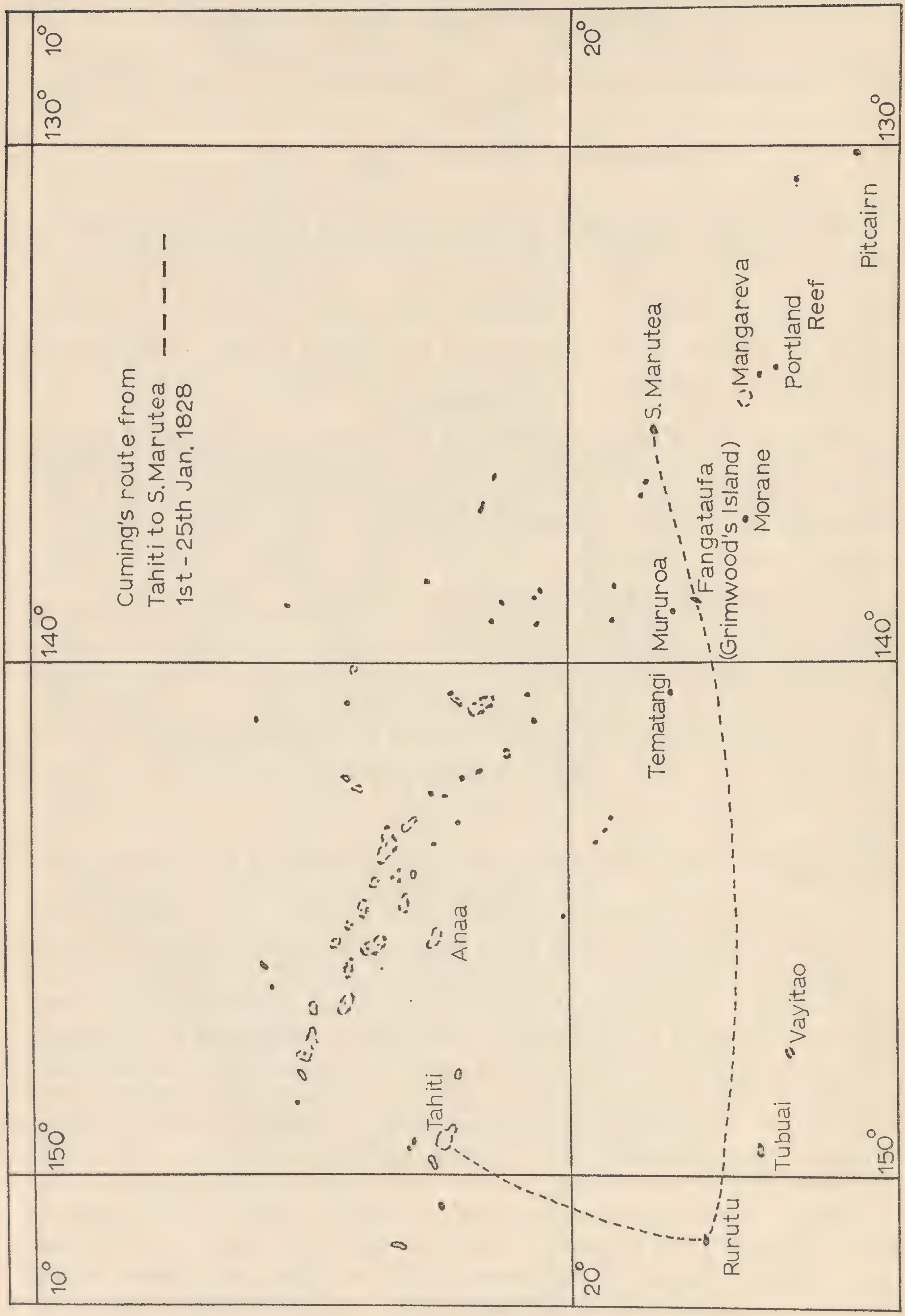
" GRIMWOOD'S ISLAND ", ITS GEOGRAPHICAL POSITION AND ITS CONNECTION WITH HUGH CUMING.

By S. P. DANCE, Department of Zoology, British Museum (Natural History).

(*Read before the Society, 9 April*, 1960)

IT is well known that much of the large shell collection amassed by Hugh Cuming (1791–1865), and later deposited in the British Museum, was collected by himself during extensive explorations in Polynesia, South America, the Philippine Islands and elsewhere (Clench, 1945). At an early age he went to South America and established himself in business as a sail maker in Valparaiso. He retired in 1826 (Melvill, 1895) and in 1827 he embarked on the first of his three major collecting voyages in the *Discoverer*, a yacht built specifically for the purpose of collecting natural history specimens (Clench, 1945). This voyage took him by way of Juan Fernandez, Easter Island and many islands of Polynesia as far as Tahiti. Fortunately this voyage is well documented, as Cuming provided a complete account in a letter to Dr. (later Sir) William Jackson Hooker written from London, 21 March 1832. This letter, one of many from Cuming, is still preserved in the Hooker correspondence in the library of the Royal Botanic Gardens, Kew, and, with the exception of a short introductory passage, is reproduced in full by St. John (1940). Apart from its value as an accurate record of Cuming's itinerary in Polynesia, it is a very interesting and human document that reveals something of the hazards attendant upon travel in a remote quarter of the Pacific at that time. It also affords us a glimpse of the character of a most exceptional man.

Although the names given to most of the islands are no longer in use, it is possible to ascertain their modern equivalents without any trouble—all but one. The exception is " Grimwood's Island ". This name occurs in the following passage which gives his route from Tahiti, which he left on 1 January 1828, bound for Lord Hood's Island or, as it is now called, South Marutea. " On the 10th made the island of Oheteroa of Capt. Cook and Ruruta [Rurutu] of the natives. This island is high and well wooded, producing a number of fine timber for various purposes, several Ferns and many shrubs without flowers or fruit. Natives kind, hospitable and virtuous, here the benefit of the Missionaries labours is to be seen in perfection. At night sailed, as the vessel would not come to an anchor and at the same time a gale arising ; on the 19th made a small Lagoon Island and landed. Same vegetation as at Ducies Island. Here we saw wrecks of several canoes but not any inhabitants. As this island was not laid down on any chart I named it Grimwood's Island after the Master of the Discoverer. On the 25th of January landed on Lord Hoods the second time. . . ." St. John (1940) says that " it was probably a south-western atoll of the Tuamotu Archipelago ". Wishing to pin-point it still further, I wrote to Dr. H. A. Rehder of the Division of Mollusks, U.S. National Museum, who had recently spent some weeks in the Tuamotu Archipelago. He



Map showing the position of "Grimwood's Island" in the Tuamotu Archipelago, South-East Pacific.

replied (5.9.1958) "I believe that the island that Cuming named Grimwood's Island is probably the atoll called Fangatau (also called Fangataufa) or Cockburn Island, discovered and named by Capt. F. W. Beechey in February 1826, and lying south-east of Mururoa (or Matilda or Osnaburgh Island). Since Beechey did not return to England until October 1828, this island would not have been on any charts that Cuming had at his disposition. This island could very well be sighted on the trip from Rurutu to South Marutea and fits in with the sailing times mentioned by Cuming".

The importance of establishing the exact position of "Grimwood's Island" is not entirely academic as it is the type locality of at least four molluscan species collected there by Cuming, and, therefore, it has entered scientific literature. These species are *Scutella iridescens* Broderip (1834), *Scutella rosea* Broderip (1834), *Buccinum cumingii* Powis (1835) and *Stomatella speciosa* A. Adams (1850).

It is hoped that this note will obviate fruitless search among the literature by workers wishing to determine the situation of "Grimwood's Island".

I wish to acknowledge my obvious debt to Dr. H. A. Rehder, but for whose help this note would have been very incomplete.

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SUPPLEMENTARY NOTE

While the above was in the press, Dr. Rehder (3rd November, 1960) drew attention to his own more comprehensive account, "L'identité de l'Ile Grimwood" (*Bull. Soc. Étud. océanien,* 1959, Nos. 127 and 128, 46–8), to which mine adds little more than a map.

CYPRAEA BRODERIPI SOWERBY, ANOTHER REMARKABLE ADDITION TO THE SOUTH AFRICAN MARINE FAUNA.

By S. P. Dance, Department of Zoology, British Museum (Natural History).

(*Read before the Society*, 9 *April* 1960.)

The genus *Cypraea* is noteworthy for a number of species that are both beautiful and rare. One of these is *C. broderipi* Sowerby. So far as I am aware, only three specimens are known in collections. These are the holotype, from the Hugh Cuming collection, now in the British Museum (Natural History), and two in the Saul collection, now in the University Museum of Zoology, Cambridge. The existence of these specimens has been known for over 100 years and none has been reported since. The holotype was said to be from Madagascar and the other two are without original locality data. A fourth specimen may now be reported together with reliable information on its locality.

The specimen (B.M. Reg. No. 1956.6.30.5) was discovered recently among a small collection of shells presented by Mr. W. Bell-Marley to the British Museum (Natural History) in 1956. These shells are remarkable in that every one was taken from the stomach contents of specimens of the Natal mussel-crusher, *Cymatoceps nasutus* (Castelnau), a fish that may weigh 60 pounds or more and habitually feeds on molluscs taken from the sea floor (Bell-Marley, 1927). The fish from which the *C. broderipi* was obtained was taken off Durban, South Africa, in 1928. Although there is no indication of the depth at which it was taken, it is a deep-water species, and is often taken by deep-sea anglers. Sometimes the stomach of the fish is distended with nothing else but the remains of fish and decomposed molluscs picked up from the bottom (Bell-Marley, 1927).

Although it is in very poor condition, the Durban specimen compares favourably in several important diagnostic features with the holotype of *C. broderipi*. The measurements of the two shells are as follows :

	Holotype	*Durban specimen*
	mm.	mm.
Length . . .	66·0	75·5
Diameter . . .	44·0	52·0
Height	37·0	40·5

The enamel and dorsal markings are totally absent from the Durban specimen with the exception of a narrow, brownish line of reticulations on the right side just above the margin. These markings are characteristic of *C. broderipi* and are well seen on the dorsum of the holotype. Another noticeable feature, shared by both specimens, is the presence of small, whitish callosities along the right margin. They are more prominent towards the anterior and posterior extremities. In other features it accords well with the definition of the species as given by Schilder & Schilder (1938–39, p. 177).

Thus, yet another species of distinction and interest can be added to the rich mollusc fauna of the Cape marine province. (For details of other recent additions see Dance, 1959, and Barnard, 1960.)

The Durban shell was compared with the holotype and other specimens of the closely similar *C. nivosa* Broderip, from the Museum collection. This comparison showed that it is larger and relatively broader, with the extremities less margined, the teeth more produced, and the fossula projecting in front but constricted behind. The base is pale buff in colour, whereas the base of *C. nivosa* is creamy-white. The whitish callosities are absent from all the specimens of *C. nivosa*.

There is some resemblance also between the Durban shell and large examples of *C. vitellus* L. However, the base of *C. vitellus* is off-white and the sides show sand-like striae which are characteristic of the species. Shortly after this paper was read I received from Mrs. H. Boswell of Johannesburg another shell, taken from the stomach of a fish (species unknown) from deep water off Natal. It was smaller than the Durban shell and retained the distinguishing characters of *C. vitellus*. Without more adequate material it is not possible to demonstrate the relationship, if any, between *C. broderipi* and *C. vitellus*.

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***Potamopyrgus jenkinsi* (Smith) in Orkney.**—This indefatigable colonist was first taken in Orkney by C. Oldham who in July 1927 (*J. Conch.* **18,** 272, 1928) found it in the lochs of Stenness and Harray on Mainland, the largest island. Since then it has spread and now seems to be invading the other islands of the group. Recently I have seen it in three of the other islands, namely Hoy, Shapinsay and North Ronaldsay. In 1957 on Hoy it swarmed in a disused mill-dam at Selwick, and also occurred sparingly in a small sea-glen between Selwick and Braebister. North Ronaldsay, the most remote of the inhabited Orkney islands, was visited in 1958 and *P. jenkinsi* was found abundantly in a disused mill-race off Hookins Loch, and also a few specimens in the very limy Garson Loch. In 1959 I examined the curious lagoons known as Vaso lochs on the western coast of Shapinsay, and found *P. jenkinsi* in the southern loch, though specimens did not seem to be abundant. In every case the ecardinate form only was obtained.

N. F. MCMILLAN.

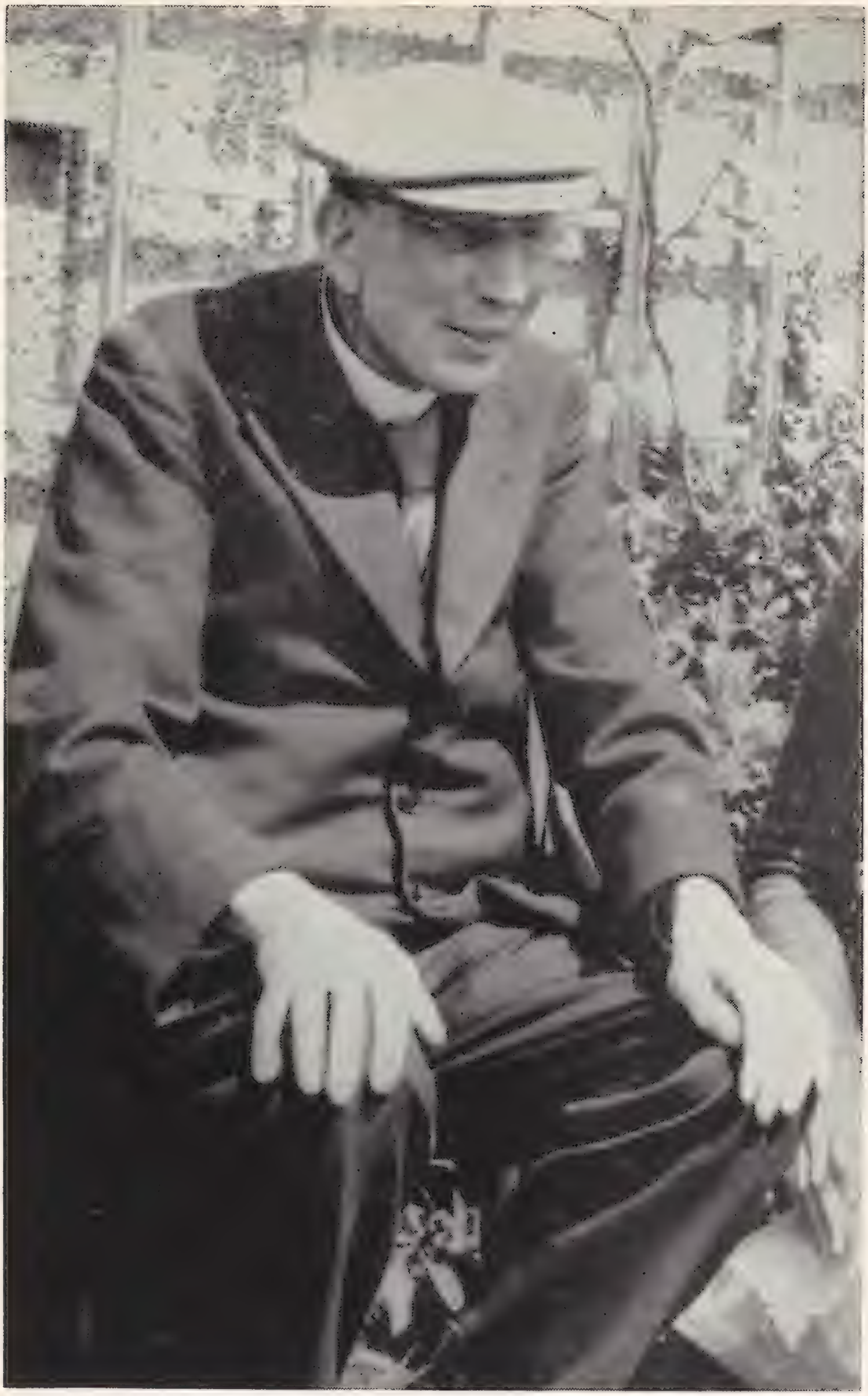
(*Read before the Society*, 16 *January* 1960.)

OBITUARY

H. H. Bloomer, 1866–1960.

Harry Howard Bloomer was born in Birmingham on 28 October 1866, and died on 15 June 1960, in a nursing home at High Wycombe, Bucks., after a short illness. His school education was of an elementary character which he supplemented by much hard study in later years. Following a year's ill health he entered a chartered accountant's office and qualified as a chartered accountant in 1893. In the same year he was taken into partnership and, in 1900, became senior partner of the firm. After his final professional examination he attended the evening classes in geology at Mason College (afterwards Birmingham University) and a special course in biology held on Saturdays. The last two years of the biology course were devoted to the Mollusca. In later years he spent his holidays at Hornell's laboratory, Jersey, and at the Marine Biological Station, Plymouth; he also visited the Liverpool Marine Biological Station at Port Erin, Isle of Man. In 1909 he was offered a research table at Birmingham University but his professional duties did not allow him to make full use of it. Although he died at an advanced age he did not enjoy good health and, in 1911, he sailed to Australia and stayed some months. There he met the famous Australian malacologist Charles Hedley and, when in Queensland, he spent much time shell collecting and botanizing with another Australian naturalist, John Shirley. In the following year he visited the Azores. He retired from practice in 1929 and moved to Swanage in Dorset where he spent the rest of his life.

His earliest malacological paper (" On some malformed specimens of *Anodonta cygnaea* L." *Journ. Malac.* 1900, **7**, 136–138) was the first of a long series of studies on the Unionidae that earned for him a wide reputation. Over fifty years later, his final paper (" A note on the distribution of *Anodonta cygnaea* (L.), having regard to the differences in sex and gill-structure. IV." *J. Conch.* 1954, **23**, 395–397) shows how ingrained was his love of the larger freshwater bivalves. From 1901 to 1912 he produced a series of important papers on the anatomy and classification of Solenidae and one on the anatomy of the British species of *Psammobia*. Apart from a note on " The jaws and teeth of Mollusca " (*Brit. Dental Journ.* 1909, **30**, 989–994) and another on " The distribution of *Crepidula fornicata* L." (*J. Conch.* 1945, **22**, 147), the rest of Bloomer's malacological writings were concerned solely with the Unionidae, and with the British species of *Anodonta* in particular. His Presidential Address, read to our Society on 19 October 1929, had for its subject " The British Anodontas " (*J. Conch.* 1930, **19**, 11–17). This was followed up by his much more comprehensive paper " The British Species of *Anodonta* Lamarck, and their varieties ". (*J. Conch.* 1938, **21**, 33–48). A most useful feature of this paper is the series of plates, eight in number, depicting most of the " varieties " that have been recorded from Britain at some time or another. Most of the plates reproduce earlier published figures. In his papers on Unionidae, he was much concerned with problems of sex, fertilization, and gill-structure.



H. H. Bloomer

[*To face p.* 448

Bloomer was elected a member of the Conchological Society in 1907 and was President 1928–1929. He joined the Malacological Society in 1898. Before his move to Swanage he was very closely connected with natural history activities in and around Birmingham. He joined the Birmingham Natural History and Philosophical Society in 1894 and was elected President in 1927. He held several offices within this Society and was Treasurer for many years. For a number of years he was Secretary of the Vesey Club, Sutton Coldfield. He was also a Fellow of the Linnean Society, and a member of the British Ecological Society, the Marine Biological Association of Great Britain and the Botanical Society of the British Isles.

Although he made several collections in his long life he was not, in the true sense, a collector. Most of his shells were presented to the Birmingham Museum when he moved to Swanage. He presented the British Museum (Natural History) with his collection of the Myaceae soon after, and his Unionidae were acquired by the same institution shortly before his death. Among the Unionidae are specimens acquired from most of the leading authorities on the group. As might be expected this collection is disappointing from a collector's point of view. From a scientific viewpoint it contains much valuable material from habitats since destroyed.

He excelled at fly fishing and tied his own flies. He was fond of Wales and used to fish there for salmon and trout. At the age of 63 he learnt to drive a motor car. His nephew, Mr. H. K. Easton, to whom I am much indebted for some of these particulars, tells me also that " It used to be my doubtful pleasure sometimes to row my uncle up and down Little Bracebridge Pool in the park on what was generally a cold, windy day, whilst he dredged for ' fresh water mussels ' ". Bloomer's first paper was concerned with mussels from this pool. Up to the time of his death he would express his opinions upon his pet aversion—Lloyd George ! Above all he was kind and thoughtful to others and had a pleasant sense of humour. The Conchological Society is indebted to Bloomer for more than his writings. During his presidency, he proposed the establishment of a Research Fund which he opened with a generous donation of £100.

S. P. DANCE.

L. A. W. C. VENMANS, 1898–1959.

LEONARDUS ALPHONSUS WILHELMUS CORNELIS VENMANS was born at Tilburg (Netherlands) on 28 July 1898, and died on 26 December 1959. He attended the elementary school and later the Gymnasium at Tilburg, passing the final examination in 1918. He then studied Classical Literature at the University of Utrecht, at the same time attending lectures in biology and philosophy. From January 1921 until September 1923 he was a teacher of classics at the St. Catharina Lyceum, Eindhoven. After that he resumed study at the University, but this was again suspended until 1930. In this year he prepared for his " candidaats " examination, which he passed in 1931. Until 1936 he taught classics at Enschede, Amsterdam and Utrecht, and published some articles on etymological and archaeological subjects.

As a teaching career did not fully satisfy him, he went over to the Ministry of Social Affairs as an official for social welfare and labour projects. This somewhat unusual step did not give him satisfaction either, but it left him enough opportunity for work on his hobby, malacology, for which many hours of the night were sacrificed. Venmans did not specialize in one subject, but accepted opportunities for research in various directions, and was an ambitious collector. As he lived far from a university or a museum, he laid great stress on keeping a collection and library at his own expense, and maintained contact with many malacologists in different parts of the world. It was not always an easy task for his correspondents to satisfy his miscellaneous questions, or to identify the flow of unnamed specimens, often in dilapidated condition, which he profusely distributed to various museums. The great physical exertion of his official duties and of his hobby combined proved detrimental to his health, so that in later years long periods of illness interrupted his activity. Nevertheless he looked forward to his retirement in order " to begin work seriously ".

Venmans was twice married, and is survived by a widow and three sons. He was a member of the Nederlandse Malacologische Vereniging since 1937, and also of the Conchological Society and the Malacological Society of London. The Sociedad de Ciencias Naturales La Salle at Caracas nominated him a corresponding member. In 1946 the McKinley Roosevelt Institution in Chicago bestowed on him the degree of doctor of philosophy.

W. S. S. VAN BENTHEM JUTTING.

Mr. B. Verdcourt writes : " I had corresponded with Dr. Venmans for many years and had stayed with him on several occasions. He was an exceedingly kind and helpful man, with a remarkable grasp of foreign languages. He had translated several English detective novels into Dutch, besides writing papers in various languages. He had a wide knowledge of classical literature, but was scarcely sympathetic to modern scientific ideas, including evolution. He had a good collection, which was neatly catalogued and will be easily understood by anyone who has to consult it. He was particularly interested in the personalities of his malacological correspondents and kept albums of photographs." [The portrait of the late Hugh Watson reproduced in the last number of the *Journal* was kindly lent by Mevr. Venmans.]

A list of the malacological papers by Dr. Venmans was given in *Correspondentieblad van de Nederlandse Malacologische Vereniging*, No. 86, pp. 862–863 (February 1960). The following papers were omitted from this list :

1943. Een nieuwe vondst (*Avenionia bourguignati* Loc.) en een opwekking. *Natuurhist. Maandbl.* 32, 84–86, 2 figs.

1957 (Dec.). Description of the jaw and radula of two Ariophantidae. *Proc. Malac. Soc. Lond.* 32, 245–249, figs. 1–7.

1959. Notes on molluscs from the Belgian Congo. 1. Genus *Streptostele* H. Dohrn, 1866. *Rev. Zool. Bot. Afr.* 60, 31–48.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND

779th Meeting, held at the British Museum (Natural History), 19 March 1960.

The President, Mr. C. P. Castell, in the chair.

Member Elected.

Dr. R. K. Dell, 7 Prince Albert Road, London, N.W. 1.

Communications.

" *Gyrina gigantea* (Lamarck) in New Zealand waters," by S. P. Dance and R. K. Dell.

Dr. W. J. Rees gave a lecture on " Biological research in the shallow seas ", illustrated by colour transparencies.

Exhibits.

Special exhibits: Mollusca and seaweeds; British freshwater Operculates. Examples were shown by the President (from the British Museum collections), Mr. A. E. Ellis, Mr. R. P. Scase and Mr. L. W. Stratton. Mr. Dance exhibited specimens to illustrate his paper, and Dr. L. Lloyd-Evans living *Ena montana* from Hertfordshire.

780th Meeting, held at the British Museum (Natural History), 9 April 1960.

The President, Mr. C. P. Castell, in the chair.

Members Deceased.

The President announced the deaths of Mr. N. E. Pellow and Dr. L. A. W. C. Venmans.

Members Elected.

Derek Cave Insall, 5 Uno Avenue, Haifa, Israel.
Mrs. Clifton W. Johnson, c/o Arabian American Oil Company, Box 339, Ras Tanura, Saudi Arabia.
Dino Paccamiccio, Porto Potenza Picena, Macerata, Italy.

Communications.

" Some variations in the Unionidae," by L. W. Stratton.

" *Pomacea* of the Amazon river system," by T. Pain.

" *Cypraea broderipi* Sowerby, another remarkable addition to the South African marine fauna," and " Grimwood's Island: its geographical position and its connection with Hugh Cuming," by S. P. Dance.

Dr. R. K. Dell gave a lecture on the Mollusca of New Zealand, illustrated by maps and specimens.

Exhibits.

Special exhibits: Helicellinae; island fauna. Specimens were exhibited by the President, the Rev. H. E. J. Biggs, Mr. T. E. Crowley, Dr. H. E.

Quick and Mr. R. P. Scase. Mr. S. P. Dance, Mr. T. Pain and Mr. L. W. Stratton exhibited specimens to illustrate their communications.

781st Meeting, held at the British Museum (Natural History), 21 May 1960.

The President, Mr. C. P. Castell, in the chair.

Members Elected.

The Balfour Library, Department of Zoology, Downing Street, Cambridge.

John Francis Ogle-Skan, 141 Lapwing Lane, Didsbury, Manchester 20.

Communications.

" Note on *Akera bullata* Müller," by E. St. John Burton.

" *Columella edentula* (Draparnaud) and *Vertigo antivertigo* (Draparnaud) in West Sussex," by M. Goodchild.

" Mollusca of East Möen," by Fraulein Hildegard Zeissler.

Dr. Ruth Turner (Museum of Comparative Zoology, Harvard) gave a lecture on " Shipworms and History ", illustrated by lantern slides.

Exhibits.

Special exhibits : Faunas of ponds and lakes ; Pleurodontidae.
Mr. G. A. S. Barnacle : land shells from the Seychelles and East Africa.
Mr. D. Heppell : Mollusca from the Serpentine, Hyde Park, London.
Mr. T. Pain : Mollusca from Lake Tanganyika.
Mr. L. W. Stratton : Mollusca from English ponds and lakes.

INDEX TO VOLUME 24.

PAGE

Abbott, R. T., *Introducing Sea Shells* (review) 148
Acanthinula lamellata, Holocene, Cambs. 51
Acanthinula lamellata, Holocene, I. of Wight 40
Acanthinula lamellata in Pembrokeshire 252
Acanthochitona crinitus in Orkney 179
Accounts 71, 153, 225, 297, 375, 419
Achatina balteata, giant 356
Acme fusca in W. Kent 233
Acme fusca, sinistral 27
Acroloxus lacustris in Merionethshire 104
Age determination in *Anodonta* 201
Agriolimax caruanae, further note on 21
Agriolimax caruanae new to Ireland 354
Agriolimax laevis andicolus in Nairobi 410
Agriolimax reticulatus feeding on carrion 96
Allan, J., *Cowry Shells of World Seas* (review) 181
Ampullarius (and *Pomacea*) 79
Annual Meetings 67, 149, 220, 293, 363, 413
Anodonta, age determination of 201
Anodonta cygnea, recorded in error for Hebrides 218
Anodonta minima in Corfe River, Dorset 99
Anodonta minima in Dorset 110
Anodonta minima in Hampshire 218
Anodonta minima in Monmouthshire 401
Anodonta minima in W. Sussex 220
Arianta arbustorum feeding on carrion 22
Arianta arbustorum, sinistral 138
Arion ater feeding on carrion 22
Arion lusitanicus in Warwickshire 69
Arion subfuscus, blackbird feeding on 24
Aspatharia, drought resistance of 281
Astraea heliotropium 7
ATKINS, L. S., Molluscan mortality at Youghal, C. Cork 290
AZUMA, M., New locality for *Cypraea guttata* 146

BARNACLE, G. A. S., New species of *Corilla* 95
Barnard, K. H., *Contributions to the knowledge of S. African marine Mollusca* (review) 328

PAGE

BARNARD, K. H., *Glypteuthria capensis*: a generic correction 210
BARNARD, K. H., *Latiaxis fritschi* and *Fusus speratus* 327
BARNARD, K. H., New species of S. African marine Gastropods 438
BARNARD, K. H., Radula of *Cancellaria* 243
BARNARD, K. H., Radula of *Latiaxis fritschi*, and description of a new Fossarid 180, 327
BARNARD, K. H., Rediscovery of *Guivillea* 398
Bensley, J. F., obituary 213
BERRY, S. S., A tidal flat on the Vermilion Sea 81
BIGGS, H. E. J., Contribution to study of *Eremina* 332
BIGGS, H. E. J., Large example of *Potamopyrgus jenkinsi* 238
BIGGS, H. E. J., Littoral collecting in Persian Gulf 270
BIGGS, H. E. J., Mollusca from Prehistoric Jericho 379
BIGGS, H. E. J., New species of *Siphonaria* 249
BIGGS, H. E. J., Notes on *Hygromia cinctella* 177
BIGGS, H. E. J., *Nucella lapillus* with double aperture 174
BIGGS, H. E. J., *Revision of Burtoa* (review) 442
BIGGS, H. E. J., Some land Mollusca from N. Iraq 342
BIGGS, H. E. J., & COZENS, F. H., *Acme fusca* in W. Kent 233
BIGGS, H. E. J., & GRANTIER, L. L., Preliminary list of marine Mollusca of Ras Tanura, Persian Gulf 387
Bithyniinae, opercula of calcite in 349
Blackbird feeding on *Arion subfuscus* 24
Bloomer, H. H., obituary 448
British Caenozoic Fossils (review) 417
British Slugs (review) 416
BURCHELL, J. P. T., & DAVIS, A. G., Molluscan fauna of post-glacial deposits in N. Lincs. & Kent 164
BURTON, E. ST. J., Note on *Petricola pholadiformis* 251

CAIN, A. J., Inheritance of mantle colour in *Hygromia striolata* 352
CAIN, A. J., Undescribed polymorphism in *Hygromia striolata* 319

PAGE

Callochiton fulvus in R. Fal, Cornwall 80
Cancellaria, radula of . . . 243
Capt. Cook's Imperial Sun Trochus 7
Castell, C. P., obituary, J. F. Bensley 213
Catinella arenaria fossil in Notts. 230
Charitodoron 402
Check-list of E. African non-marine Mollusca . . . 322
Cheshire marl-pits, Mollusca of . 299
Clausilia bidentata with double aperture . . . 120, 287
Clausilia dubia in Malham area . 41
Coalfish feeding on *Patina pellucida* 39
Cochlicella acuta, another Sussex colony 287
Cochlicella acuta at Lewes . . 26
Cochlicella acuta dans le sud-est de l'Angleterre . . . 253
Columella columella fossil in Kent 167
Columella columella fossil in Lincs. 165
Columella edentula in W. Sussex . 445
Comfort, A., Mollusca in alluvia of R. Siagne . . . 97
Contributions to the knowledge of S. African marine Mollusca (review) 328
Contributions to study of *Eremina* 332
Corilla, new species . . . 95
Cowry Shells of World Seas (review) 181
Cox, I., *The Scallop* (review) . 266
Coxhead, P., Lewes, Sussex, field meeting 26
Cozens, F. H., *Cochlicella acuta*: another colony in Sussex . 287
Cozens, F. H. (& Biggs, H. E. J.), Note on *Acme fusca* in W. Kent 233
Cracherode Shell Collection (review) 266
Cray Valley, Kent 1
Crowley, T. E., Age determination in *Anodonta* . . . 201
Crowley, T. E., New species of *Synapterpes* 144
Crowley, T. E., *Planorbis vortex* with double aperture . . 327
Crowley, T. E., *Viviparus* eaten by crows 280
Crowley, T. E., & Pain, T., *Revision of Burtoa* (review) . 442
Crowley, T. E., & Pain, T., Unfigured species of *Plekocheilus* 234
Curator's report . . 365, 415
Curry, D., *British Caenozoic Fossils* (review) . . . 417

PAGE

Curry, D., *Cracherode Shell Collection* (review) . . 266
Curry, D., Opercula of calcite in Bithyniinae 349
Cypraea broderipi in S. Africa . 446
Cypraea guttata, new locality for . 146
Cypraea in N.W. Malaya . . 85
Cypraea lynx var. *williamsi*, type . 212
Cyprina islandica, monstrosity . 318

Dance, S. P., *Contributions to the knowledge of S. African marine Mollusca* (review) . . . 328
Dance, S. P., *Cypraea broderipi* in S. Africa 446
Dance, S. P., Drought resistance in an African freshwater Bivalve 281
Dance, S. P., Grimwood's Island 443
Dance, S. P., *Gyrina gigantea* in S. Africa 351
Dance, S. P., Large *Planorbis vorticulus* near Pevensey . . 212
Dance, S. P., New Sussex locality for *Pisidium pseudosphaerium* . 91
Dance, S. P., Note on *Helicodonta obvoluta* 278
Dance, S. P., Notes on *Pisidium* of Pevensey Levels . . . 195
Dance, S. P., Obituary, H. H. Bloomer 448
Dance, S. P., *Pisidium conventus* in L. Rannoch . . . 191
Dance, S. P., *Pisidium obtusale lapponicum* from Lower Gravel, Swanscombe . . . 147
Dance, S. P., *Sea Shells of tropical West America* (review) . . 361
Dance, S. P., 25th Anniversary of Netherlands Malacological Society 405
Dance, S. P. & Dell R. K. *Gyrina gigantea* in New Zealand 418
Davis, A. G., *Acanthinula lamellata*, Holocene, I. of Wight . 40
Davis, A. G., *Anodonta minima* in Corfe River 99
Davis, A. G., *Anodonta minima* in Dorset 110
Davis, A. G., Correction . . 26
Davis, A. G., Fauna with *Helicella striata* in Kent . . . 1
Davis, A. G., *Helicella elegans* at Walmer, Kent . . . 19
Davis, A. G., *Hygromia subvirescens* in Cornish Holocene . 100
Davis, A. G., *Hygromia subvirescens* in S. Devon . . 101
Davis, A. G., Lullingstone, Kent, field meeting . . . 25
Davis, A. G., obituary . . 214

PAGE
Davis, A. G., sinistral *Pupilla muscorum* 19
Davis, A. G., Slines Oak & Greenhill Shaw, Surrey, field meeting 26
Davis, A. G., *Truncatellina cylindrica britannica* in Dorset and I. of Wight 61
Davis, A. G., *Vertigo moulinsiana* in Dorset 193
Davis, A. G., *Vertigo moulinsiana* in Hampshire and I. of Wight 192
Davis, A. G. (& Burchell, J. P. T.), Mollusca of Post-glacial deposits in N. Lincs & Kent 164
Davis, A. G., & Pitchford, G. W., Holocene Mollusca of Southwell and Wheatley, Notts. 227
Dell, R. K. (& Dance, S. P.), *Gyrina gigantea* in New Zealand 418
Discus ruderatus fossil in Herts. 56, 57
Discus ruderatus fossil in Notts. 231
Dispersal of *Pisidium* by Corixidae 17
Distribution & synonymy of *Strophocheilus lichtensteini* 378
Dixon & Watson's *Descriptive Manual of British land and fresh-water shells* 209, 248
Dreissena polymorpha in closed pond 46
Drought resistance in African freshwater Bivalve 281

Eales, N. B., *Molluscs* (review) 328
Early breeding of *Marpessa laminata* 432
Early Post-glacial deposits in King's Co., Ireland 155
East African non-marine Mollusca, check-list 322
Edouardia herbigrada in Uganda 207
Effects of gale on S. Lancs. coast 145
Eggs of *Vitrina pellucida* 348
Ellis, A. E., *British Slugs* (review) 416
Ellis, A. E., obituary, E. W. Swanton 326
Ellis, A. E., *Studies on Loch Lomond* (review) 288
Ellis, A. E., *The Scallop* (review) 266
Ena montana in Herts. 102
Eremina 332
Eubranchus tricolor in Orkney 178
Extension du *Cochlicella acuta* dans le sud-est de l'Angleterre 253

Fernando, C. H., Dispersal of *Pisidium* by Corixidae 17
Field Meetings 25, 26
Forcart, L., New subspecies of *Jaminia continens* 315

PAGE
Further note on *Agriolimax caruanae* 21
Further note on *Lymnaea stagnalis* in Anglesey 208
Further notes on non-marine Mollusca from semi-arid area of E. Africa 142
Further Scottish records of *Potamopyrgus jenkinsi* 399

Genus *Charitodoron* 402
Giant *Achatina* from Belgian Congo 356
Glypteuthria capensis: a generic correction 210
Goodchild, M., *Columella edentula* and *Vertigo antivertigo* in W. Sussex 445
Grantier, L. L. (& Biggs, H. E. J.), Mollusca of Ras Tanura 387
Granules from Post-glacial deposits in Lea Valley 139
Greenhill Shaw, Surrey, field meeting 26
Grensted, L. W., Effects of gale on S. Lancs. coast 145
Griffiths, R. J., *Cowry Shells of World Seas* (review) 181
Griffiths, R. J., *Cypraea* in N. W. Malaya 85
Griffiths, R. J., Lt. Hankey and *Cypraea* growth 265
Grimwood's Island 443
Groundwater, W., *Hygromia hispida* at Stromness, Orkney 397
Guivillea, rediscovery of 398
Gyrina gigantea in New Zealand 418
Gyrina gigantea in S. Africa 351

Haliotis alfredensis 279
Haliotis speciosa 278
Hamilton, J. D. (& Hunter, W. R.), *Pisidium* from Hirta, St. Kilda 247
Hankey, Lt., and *Cypraea* growth 265
Hayward, J. F., Further note on *Agriolimax caruanae* 21
Hayward, J. F., Granules from Post-glacial deposits in Lea Valley 139
Hayward, J. F., Molluscan sequence in Lea Valley 239
Helicella caperata, scalariform 26
Helicella elegans at Walmer, Kent 19
Helicella geyeri fossil in Kent 3, 4, 167
Helicella gigaxi in Ireland 283
Helicella striata fossil in Kent 1, 167
Helicodonta obvoluta fossil in Kent 220
Helicodonta obvoluta, note on 278

PAGE

Helix hortensis, sinistral 138
Helix menoralis in calcium-free habitat 54
Helix pomatia with abnormal genital ducts 12
Hertfordshire, Mollusca of (notice) 58
Hill Collection 80
Hoestlandt, H. (& De Leersnyder, M.), *Cochlicella acuta* dans le sud-est de l'Angleterre 253
Holme, N. A., *Saxicavella jeffreysi* at Plymouth 325
Holocene Mollusca of Southwell & Wheatley, Notts. 227
Hunter, W. R., Mollusca from limestone in Skye 171
Hunter, W. R., & Hamilton, J. D., *Pisidium* from Hirta, St. Kilda 247
Hunter, W. R., & M., Mollusca on Scottish mountains 80
Hunter, W. R., & M., Roebuck's papers on Scottish non-marine Mollusca 59
Hunter, W. R., & Slack, H. D., *Pisidium conventus* in L. Lomond 245
Hygromia cinctella, notes on 177
Hygromia hispida at Stromness, Orkney 397
Hygromia hispida on Hoy, Orkney 395
Hygromia liberta & *H. hispida* living together 397
Hygromia liberta fossil in Herts. 56
Hygromia limbata in Iraq 343
Hygromia limbata, new locality for 20
Hygromia striolata, inheritance of mantle colour 352
Hygromia striolata, polymorphism in 319
Hygromia striolata, scalariform 26, 28
Hygromia subrufescens & *H. subvirescens* living together 418
Hygromia subvirescens in Cornish Holocene 100
Hygromia subvirescens in Pembrokeshire 437
Hygromia subvirescens in S. Devon 101

Imperial Sun Trochus 7
Ingram, H., Hugh Watson, an appreciation 360
Inheritance of mantle colour in *Hygromia striolata* 352
Introducing Sea Shells (review) 148
Iraq, N., land Mollusca of 342

Jackson, J. W., Dixon & Watson's *Descriptive Manual of British land and fresh-water shells* 248
Jaeckel, S. H., *Kopffüsser* (review) 267

PAGE

Jaminia continens, new subspecies 315
Jutting, W. S. S. van B., obituary, L. A. W. C. Venmans 449

Keen, A. M., *Sea shells of tropical West America* (review) 361
Kerney, M. P., Early Post-glacial deposits in King's Co., Ireland 155
Kerney, M. P., Former occurrence of *Vertigo parcedentata* in Herts. 55
Kerney, M. P., *Lauria sempronii* in English Holocene 183
Kerney, M. P., *Margaritifera auricularia* in English Pleistocene 250
Kerney, M. P., Mollusca from alluvium of New River 211
Kerney, M. P., *Monacha cantiana* in Pembrokeshire 244
Kerney, M. P., obituary, A. G. Davis 214
Kerney, M. P., *Planorbis laevis* in Surrey 54
Kerney, M. P., & May, F., *Planorbis vorticulus* in Thames valley 403
Kevan, D. K., Scottish records of *Potamopyrgus jenkinsi* 399
Kingdom of the Octopus (review) 289
Kopffüsser (*Tintenfische*), review 267

Lane, F. W., *Kingdom of the Octopus* (review) 289
Large *Planorbis vorticulus* 212
Large *Potamopyrgus jenkinsi* 238
Latiaxis fritschi & *Fusus speratus* 327
Latiaxis fritschi radula 180
Lauria anglica at Meathop Fell Westmorland 62
Lauria anglica at St. Ishmaels, Pem. 268
Lauria sempronii in English Holocene 183
Leersnyder, M. De, & Hoestlandt, H., *Cochlicella acuta* dans le sud-est de l'Angleterre 253
Levantina kurdistana, anatomy 347
Lewes, Sussex, field meeting 26
Lieut. Hankey and *Cypraea* growth 265
Limax poirieri near Reading 398
List of Members 368
List of Officers & Council 109, 221, 269, 331, 377
Littoral collecting in Persian Gulf 270
Liver-fluke snails in Britain (review) 212
Lloyd-Evans, L., *Acanthinula lamellata* in Pembrokeshire 252

PAGE

Lloyd-Evans, L., *Acroloxus lacustris* in Merionethshire . . 104
Lloyd-Evans, L., *Ena montana* in Hertfordshire . . . 102
Lloyd-Evans, L., *Hygromia subvirescens* in Pembrokeshire . 437
Lloyd-Evans, L., *Vertigo substriata* in Hertfordshire . . 208
Lullingstone, Kent, field meeting 25
Lymnaea auricularia, two forms in one pond 93
Lymnaea stagnalis in Anglesey, 101, 208

MacDonald, R., & MacWilliams, J. G., Raised beach section at Groomsport, Co. Down . 103
McMillan, N. F., Dixon & Watson's *Descriptive Manual* of *British land and fresh-water shells* 209
McMillan, N. F., *Hygromia hispida* on Hoy, Orkney . . 395
McMillan, N. F., *Lymnaea stagnalis* in Anglesey . . 101, 208
McMillan, N. F., Marine aliens in Cornwall 80
McMillan, N. F., Mollusca of Cheshire marl-pits . . 299
McMillan, N. F., Mollusca of Patrick's Wood, Cheshire . 13
McMillan, N. F., *Monacha cantiana* in Fife . . . 406
McMillan, N. F., Non-marine Mollusca in N.E. Scotland . 393
McMillan, N. F., Note on the number of snails . . . 24
McMillan, N. F., *Potamopyrgus jenkinsi* in Orkney . . . 447
McMillan, N. F., Range of *Planorbarius corneus* . . 63
McMillan, N. F., Stelfox collection 285
McMillan, N. F., Two forms of *Lymnaea auricularia* in one pond 93
McMillan, N. F., Types of *Cypraea lynx* var. *williamsi* . 212
McMillan, N. F., Validity of name *Eulima candida* . . 286
Makings, P., *Agriolimax caruanae* new to Ireland . . . 354
Malham, Yorks, Mollusca of . 111
Marine aliens in Cornwall . . 80
Marine Mollusca of Ras Tanura . 387
Margaritifera auricularia in English Pleistocene . . 250
Marpessa laminata, early breeding 432
May, F. (& Kerney, M. P.), *Planorbis vorticulus* in Thames Valley 403
Melanoides tuberculata at Kew . 268
Members, List of . . . 368
Mollusca from Prehistoric Jericho 379
Mollusca from limestone in Skye 171
Mollusca in alluvia of R. Siagne . 97
Mollusca of Cheshire marl-pits . 299
Mollusca of Hertfordshire (notice) 58
Mollusca of Malham area . . 111
Mollusca of Patrick's Wood, Cheshire 13
Mollusca on Scottish mountains . 80
Mollusca Orcadensia (review) . 182
Molluscan fauna from alluvium of New River 211
Molluscan fauna of early Postglacial deposits in N. Lincs. & Kent 164
Molluscan mortality at Youghal, Co. Cork 290
Molluscan sequence in Lea Valley 239
Molluscs (review) . . . 328
Monacha cantiana in Fife . . 406
Monacha cantiana in Pembrokeshire 244
Monographic revision of *Burtoa* (review) 442
Monstrosity of *Cyprina islandica* . 318
Morton, J. E., *Molluscs* (review) . 328
Mozley, A., *Introduction to molluscan ecology* (review) . . 25
Mozley, A., *Liver-fluke snails in Britain* (review) . . . 212
Mozley, A., *Sites of Infection* (review) 104
Mya arenaria in Orkney . . 39

Netherlands Malacological Society 405
New locality for *Cypraea guttata* . 146
New locality for *Hygromia limbata* 20, 343
New species of *Corilla* . . 95
New species of *Siphonaria* . . 249
New species of South African marine Gastropods . . 438
New species of *Synapterpes* . 144
New Sussex locality for *Pisidium pseudosphaerium* . . . 91
Non-marine Mollusca in N.E. Scotland 393
Note on *Acme fusca* in W. Kent . 233
Note on *Helicodonta obvoluta* . 278
Note on *Petricola pholadiformis* . 251
Note on the number of snails . 24
Notes on Dixon & Watson's *Descriptive Manual of British land and fresh-water shells* 209, 248
Notes on *Hygromia cinctella* . 177
Notes on *Pisidium* of Pevensey Levels 195
Notes on *Pomacea* and *Ampullarius* 79

PAGE

Notes on Quaternary deposits in Cambridge region . . . 47
Notes on *Vertigo moulinsiana* in Hants. & I. of Wight . . 192
Nucella lapillus with double operculum 174

Obituary :—
  Bensley, J. F. 213
  Bloomer, H. H. 448
  Davis, A. G. 214
  Swanton, E. W. 326
  Tomlin, J. R. le B. . . . 29
  Venmans, L. A. W. C. . . 449
  Watson, H. . . . 359, 407
  Wilkins, G. L. 216
Officers & Council 109, 221, 269, 331, 377
On a collection of *Pomacea* from Colombia 73
On a new subspecies of *Placostylus fibratus* 276
On an unfigured species of *Plekocheilus* 234
On the distribution & synonymy of *Strophocheilus lichtensteini* . 378
On the former occurrence of *Vertigo parcedentata* in Herts. 55
On the occurrence of *Margaritifera auricularia* in the English Pleistocene 250
Opercula of calcite in Bithyniinae 349
Orthalicus labeo 357

Pacific Sea Shells (review) . . 288
Pain, T., Distribution & synonymy of *Strophocheilus lichtensteini* 378
Pain, T., Giant *Achatina* from Belgian Congo 356
Pain, T., Non-marine Mollusca from semi-arid areas of E. Africa 142
Pain, T., *Orthalicus labeo* . . 357
Pain, T., *Placostylus fibratus*, new subspecies 276
Pain, T., *Pomacea* & *Ampullarius* 79
Pain, T., *Pomacea* from Colombia 73
Pain, T., *Pomacea* of Sierra de Merida, Venezuela . . . 175
Pain, T. *Pomacea* of the Amazon river system 421
Pain, T. (& Crowley, T. E.), On an unfigured species of *Plekocheilus* 234
Pain, T. (& Crowley, T. E.), Revision of *Burtoa* (review) . 442
Pangbourne, Berks, field meeting 25
Patina pellucida, coalfish feeding on 39

PAGE

Patrick's Wood, Cheshire, Mollusca of 13
Persian Gulf, littoral collecting in 270
Petricola pholadiformis . . 251
Pila africana, new subspecies . 140
Pinna fragilis in Orkney . . 174
Pisidium conventus in L. Lomond 245
Pisidium conventus in L. Rannoch 191
Pisidium, dispersal by Corixidae . 17
Pisidium from Hirta, St. Kilda . 247
Pisidium obtusale lapponicum fossil in Herts . . . 56, 57
Pisidium obtusale lapponicum fossil in Kent . . . 147, 167
Pisidium obtusale lapponicum fossil in Lincs. 165
Pisidium obtusale lapponicum from Lower Gravel, Swanscombe . 147
Pisidium pseudosphaerium at Pevensey 195
Pisidium pseudosphaerium, new locality for 91
Pitchford, G. W., *Agriolimax reticulatus* feeding on carrion . 96
Pitchford, G. W., *Arion ater* & *Arianta arbustorum* feeding on carrion 22
Pitchford, G. W., Blackbird feeding on *Arion subfuscus* . 24
Pitchford, G. W., *Dreissena polymorpha* in closed pond . 46
Pitchford, G. W., Eggs of *Theba pisana* 22
Pitchford, G. W., Eggs of *Vitrina pellucida* . . . 348
Pitchford, G. W., *Helix nemoralis* in calcium deficient habitat 54
Pitchford, G. W., *Lauria anglica* at Meathop Fell, Westmorland 62
Pitchford, G. W., Snails preyed upon by jays & magpies . . 40
Pitchford, G. W. (& Davis, A. G.), Holocene Mollusca of Southwell & Wheatley, Notts. . 227
Placostylus fibratus, new subspecies 276
Planorbarius corneus, range in British Isles 63
Planorbis laevis in Surrey . . 54
Planorbis vortex with double aperture 327
Planorbis vorticulus in Thames valley 403
Planorbis vorticulus, large . . 212
Plekocheilus taquinensis . . 234
Pomacea & *Ampullarius* . . 79
Pomacea from Colombia . . 73
Pomacea of Sierra de Merida, Venezuela 175

PAGE

Pomacea of the Amazon river system 421
Potamopyrgus jenkinsi in Orkney . 447
Potamopyrgus jenkinsi in W. Donegal 358
Potamopyrgus jenkinsi, large example 238
Potamopyrgus jenkinsi, Scottish records 399
Preliminary list of marine Mollusca of Ras Tanura . . 387
Proceedings 27, 65, 105, 148, 218, 267, 291, 329, 362, 411, 451

Quaternary deposits in Cambridge region 47
Quick, H. E., *British Slugs* (review) 416
Quick, H. E., *Helix pomatia* with abnormal genital ducts . . 12
Quick, H. E., *Hygromia liberta* and *H. hispida* living together . 397
Quick, H. E., *Hygromia subrufescens* and *H. subvirescens* living together . . . 418
Quick, H. E., *Introduction to molluscan ecology* (review) . 25
Quick, H. E., *Levantina kurdistana* (anatomy) . . . 347
Quick, H. E., *Limax poirieri* near Reading 398
Quick, H. E., *Liver-fluke snails in Britain* (review) . . . 212
Quick, H. E., obituary, Hugh Watson 359
Quick, H. E., Pangbourne, Berks, field meeting 25
Quick, H. E., *Sites of Infection* (review) 104
Quick, H. E., *Vitrina major* in Surrey 235

Radula of *Cancellaria* . . 243
Radula of *Latiaxis fritschi* . 180, 327
Raised beach section at Groomsport, Co. Down . . . 103
Range of *Planorbarius corneus* . 63
Recorder's Report, marine Mollusca . 70, 294, 416
Recorder's Report, non-marine Mollusca 69, 151, 222, 295, 365, 415
Records of Veronicellidae from E. Africa 392
Rediscovery of *Guivillea* . . 398
Rees, W. J., *Kingdom of the Octopus* (review) . . . 289
Rees, W. J., *Kopffüsser* (review) . 267
Rees, W. J., obituary, G. L. Wilkins 216
Rees, W. J., Shell collections of E. R. Sykes 23

PAGE

Rendall, R., Coalfish feeding on *Patina pellucida* 39
Rendall, R., *Eubranchus tricolor* in Orkney 178
Rendall, R., *Mollusca Orcadensia* (review) 182
Rendall, R., *Mya arenaria* in Orkney 39
Rendall, R., *Pinna fragilis* in Orkney 174
Retinella petronella fossil in Herts. 106
Reviews 25, 104, 148, 181, 212, 266, 288, 328, 361, 416, 442
Ricketts, H. O., New molluscan names proposed by J. R. le B. Tomlin 33
Roebuck's papers on Scottish non-marine Mollusca . . 59

Salisbury, A. E., obituary, J. R. le B. Tomlin . . 29
Saxicavella jeffreysi at Plymouth 325
Scallop, The (review) . . 266
Scalariform *Helicella caperata* . 26
Scalariform *Hygromia striolata* 26, 28
Schlesch, H., *Clausilia bidentata* with double aperture . . 287
Schlesch, H., Monstrosity of *Cyprina islandica* . . . 318
Schlesch, H., Sinistral *Oxychilus cellarius* 138
Scottish non-marine Mollusca, Roebuck's papers on . . 59
Sea Shells of Tropical West America (review) . . . 361
Shell collections of E. R. Sykes . 23
Short history of *Helicella gigaxi* in Ireland 283
Siagne, R., Mollusca of . . 97
Sinistral *Acme fusca* . . . 27
Sinistral *Arianta arbustorum* . 138
Sinistral *Helix hortensis* . . 138
Sinistral *Oxychilus cellarius* . 138
Sinistral *Pupilla muscorum* . . 19
Sinistral *Vertigo antivertigo* . 232
Siphonaria, new species . . 249
Slack, H. D. (& Hunter, W. R.), *Pisidium conventus* in L. Lomond 245
Slack, H. D., *Studies on Loch Lomond* (review) . . . 288
Slines Oak, Surrey, field meeting 26
Snails preyed upon by jays & magpies 40
Some land Mollusca from N. Iraq 342
Some variations in the Unionidae 433
South African marine Gastropoda 438
Sparks, B. W., Quaternary deposits in Cambridge region . 47
Stelfox collection . . . 285

PAGE

Stelfox, A. W., History of *Helicella gigaxi* in Ireland . 283
Stelfox, A. W., *Potamopyrgus jenkinsi* in W. Donegal . 358
Stratton, L. W., *Clausillia dubia* in Malham area . 41
Stratton, L. W., Early breeding of *Marpessa laminata* . 432
Stratton, L. W., *Mollusca of Hertfordshire* (notice) . 58
Stratton, L. W., Mollusca of Malham area . 111
Stratton, L. W., New locality for *Hygromia limbata* . 20
Stratton, L. W., *Pacific Sea Shells* (review) . 288
Stratton, L. W., Some variations in Unionidae . 433
Stratton, L. W., Two unusual snail colonies . 323
Studies on Loch Lomond (review) 288
Strophocheilus lichtensteini . 378
Succinea oblonga fossil in Herts. . 56
Succinea oblonga fossil in Kent . 167
Succinea oblonga fossil in Lincs. . 165
Swanton, E. W., obituary . 326
Sykes, E. R., Shell collections . 23
Synapterpes, new species . 144

Talmadge, R. R., *Haliotis speciosa* 278
Theba pisana, eggs . 22
Tidal flat on Vermilion Sea . 81
Tinker, S. W., *Pacific Sea Shells* (review) . 288
Tomlin, J. R. le B., New names proposed by . 33
Tomlin, J. R. le B., obituary . 29
Trochus imperialis . 7
Truncatellina cylindrica britannica in Dorset & I. of Wight . 61
Truncatellina cylindrica fossil in Kent . 3, 28
Twenty-fifth anniversary of Netherlands Malacological Society . 405
Two forms of *Lymnaea auricularia* in one pond . 93
Two new subspecies of *Jaminia continens* . 315
Two unusual snail colonies . 323
Types of *Cypraea lynx* var. *williamsi* . 212

Undescribed polymorphism in *Hygromia striolata* . 319
Unionidae, some variations . 433

PAGE

Validity of *Eulima candida* . 286
Vallonia tenuilabris fossil in Essex . 48, 49
Vasconiella jeffreysiana . 411
Venmans, L. A. W. C., New subspecies of *Pila africana* . 140
Venmans, L. A. W. C., obituary . 449
Verdcourt, B., *Agriolimax laevis andicolus* in Nairobi . 410
Verdcourt, B., Check-list of E. African non-marine Mollusca 322
Verdcourt, B., *Edouardia herbigrada* in Uganda . 207
Verdcourt, B., Hugh Watson . 407
Verdcourt, B. Records of Veronicellidae from E. Africa . 392
Veronicellidae from E. Africa . 392
Vertigo alpestris fossil in Kent . 3, 4
Vertigo alpestris fossil in King's Co., Ireland . 28
Vertigo alpestris fossil in Notts. . 231
Vertigo angustior fossil in Notts. . 231
Vertigo antivertigo in W. Sussex . 445
Vertigo antivertigo, sinistral . 232
Vertigo moulinsiana fossil in Notts. 231
Vertigo moulinsiana in Dorset . 193
Vertigo moulinsiana in Hampshire 192
Vertigo moulinsiana in I. of Wight 192
Vertigo parcedentata fossil in Herts. . 55
Vertigo parcedentata fossil in Kent 167
Vertigo parcedentata fossil in Lincs. . 165
Vertigo parcedentata fossil in Notts. . 231
Vertigo pusilla fossil in Herts. 56, 57
Vertigo pusilla fossil in Kent . 3, 4
Vertigo pusilla fossil in Notts. . 231
Vertigo substriata fossil in Herts. 56, 57
Vertigo substriata fossil in Notts. . 231
Vertigo substriata in Hertfordshire 208
Vitrina major in Surrey 224, 235, 286
Vitrina pellucida, eggs . 348
Viviparus eaten by crows . 280

Watson, H., obituary . 359, 407
Wilkins, G. L., Capt. Cook's Imperial Sun Trochus . 7
Wilkins, G. L., *Cracherode Shell Collection* (review) . 266
Wilkins, G. L., *Introducing Sea Shells* (review) . 148
Wilkins, G. L., *Mollusca Orcadensia* (review) . 182
Wilkins, G. L., obituary . 216
Woodward, F. R., *Anodonta minima* in Monmouthshire . 401

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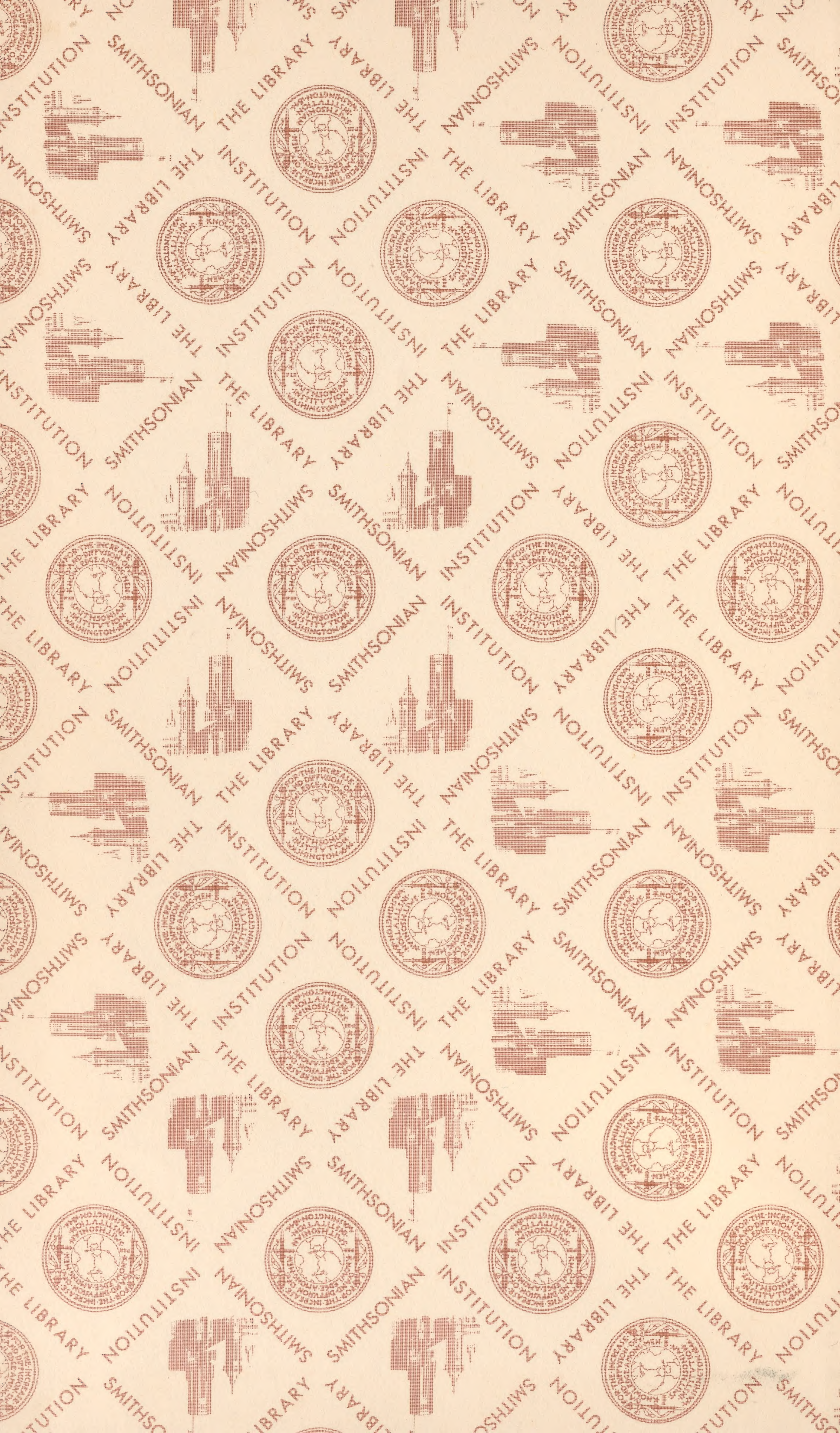
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